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SCIENTIFIC AMERICAN

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Vol. XCVIII.—No. 25.
ESTABLISHED 1845.

NEW YORK. JUNE 20, 1908.

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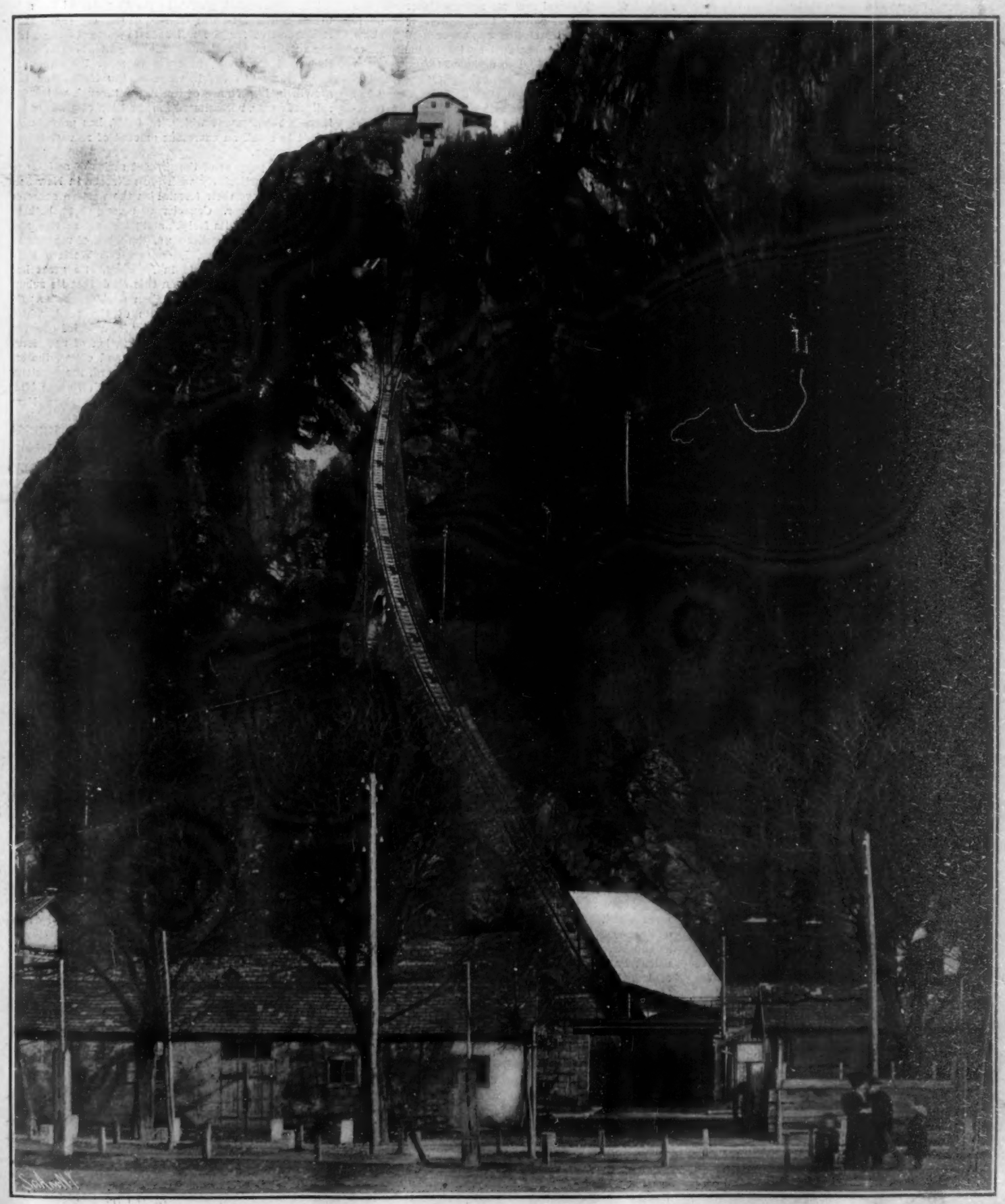

The Road Rises to the Virgl Terrace Above Bozen, Tyrol, with a Gradient of 70 Per Cent in the Upper Half While the Remainder Has a Gradient of 66 Per Cent.

A REMARKABLE MOUNTAIN RAILWAY.—[See page 446.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JUNE 20, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE COST OF GOVERNMENT.

If we except the most active period of the civil war, the total drafts upon the Treasury of the United States during the past Congress have been greater than at any period in our history. In the year 1865 the total appropriation was $1,309,000,000, of which $1,030,000,000 was spent upon the army. The appropriations for the fiscal year 1909 reached a total of $1,007,086,569. The largest appropriation for a single department was that for the Post Office, which was over $224,000,000. The next in size was that for pensions of over $163,000,000. The permanent annual appropriation is over $154,000,000. The most significant feature of the appropriations during the year is the great amount of attention that has been given to the building up of the military branch of the government; and the expenditures for the army and navy, if we leave out of account the years when the country was in the throes of the civil war, have been the largest made in the history of the country. The army was granted over $95,000,000; over $9,500,000 was appropriated for carrying on the fortification of our sea coast, and $846,000 was appropriated for the Military Academy. Moreover, under military expenses should be included the $163,000,000 which will be spent on pensions. If we add to this the sum of $123,000,000 appropriated for the navy, we get a total expenditure for military purposes, of one kind or another, direct or indirect, of nearly $400,000,000, a truly colossal sum, when we bear in mind that our standing army to-day is not over 70,000 in strength.

THE DOUBLE-FLOW TURBINE.

It sometimes happens that in the course of the development of some particular form of mechanical construction, there will be a return to an earlier discarded type. A striking instance of this is afforded in the latest design of the Parsons turbine, as developed by the firm which controls this type in the United States. The original Parsons turbine, built in 1880, was of what is known as the double-flow type, the steam entering at the center and passing laterally in opposite directions to the exhaust. With the growth in the size of separate units, the point was ultimately reached where the dimensions were such as to involve certain disadvantages, and render desirable a return to the double-flow type. In a large turbine recently completed, the design embodies two identical Parsons turbines, placed end to end, the steam entering at the center and flowing through them in opposite directions. It follows that the axial thrust on the blades, due to the difference of pressure between the inlet and outlet of each element, is exactly the same in both sections. Consequently, under all conditions of pressure, vacuum, and load, a perfect steam balance is obtained. By this arrangement it becomes possible to dispense with the balance piston as used in the single-flow turbine, in which the steam enters at one end and exhausts at the other. Another advantage is that this type is admirably adapted to utilize the exhaust steam from a reciprocating engine or a high-pressure turbine of the impulse type; the engine and the turbine operate together electrically, and the use of a governor on the low-pressure turbine becomes unnecessary. It is explained by the Westinghouse Company, who have recently built a 5,000-kilowatt double-flow turbine for the Pittsburg Railways Company, that the advantages of the double-flow design are peculiar to large turbines, and are not so marked in the smaller units. This is due to the fact of the mechanically satisfactory design of the single-direction type, and partly to the fact that in small units the economy of the two sets of turbine blades would not be as good as would be secured with a single set with double the capacity. In very large sizes, such as the machine under consideration, however, each set of blades is of such capacity that it is possible to reach as high economy as could be obtained with a single set of double the capacity.

GOVERNMENT TESTS OF RAILWAY SAFETY DEVICES.

The sundry civil appropriation bill, passed at the recent session of Congress, contains a provision which is certain to have important results in promoting the safety of railway travel. It will be remembered that the fifty-ninth Congress directed the Interstate Commerce Commission to investigate and report on the subject of block signal systems and appliances for the automatic control of railway trains. Subsequently it was found that this resolution was too limited to allow the board of experts appointed by the Commission to consider many of the devices designed to promote the safety of railway travel presented to it for investigation. With a view to placing such devices on the same footing as block signal systems and automatic train-stopping appliances, Congress at its last sitting authorized the Commission to experimentally test *any* appliances which commended themselves as being likely to promote the safety of railway operation.

The Interstate Commerce Commission has appointed a board to investigate block signal systems and appliances for the automatic control of trains, which is known as the Block Signal and Train Control Board, and consists of the following members: Mortimer E. Cooley, chairman, Dean of the Department of Engineering, University of Michigan; Azel Ames, Jr., signal engineer, electric zone, New York Central and Hudson River Railroad; Frank G. Ewald, consulting engineer of the Railroad and Warehouse Commission of Illinois; and B. B. Adams, associate editor of the Railroad Gazette.

The Commission is prepared to examine the plans and description of any appliance or system, in advance of any examination of an installation of same. For this purpose, the specifications and drawings usually filed in the Patent Office are entirely acceptable. Models are not desired, but will, as a rule, be examined. There is an objection against models, on the ground that they often work well when a full-sized apparatus might not. Under the law, the installation of the device has to be made at the expense of the party who offers it for trial. If, upon examination of drawings and specification, the Commission or its board of experts should consider the invention to be meritorious, they will authorize or request the installation of a full-sized working apparatus.

The field of invention to which attention is thus invited by the United States government should prove decidedly attractive. Not only will their devices be sure of an impartial investigation, but the chances of the adoption of the accepted apparatus with an expert indorsement to back it up should be exceedingly good.

CONGRESS INCREASES PATENT OFFICE SALARIES.

It affords us much pleasure to announce that the appropriation for the increase in salaries of the Patent Office staff, which had been stricken out of the general appropriation bill, was restored at the last moment in the Senate, and finally passed both Houses. This is a recognition of the services of a highly qualified and hard-working body of professional men, which should have been made many years ago. No one will contend that the salary of the principal examiners, of but $2,500 a year, for instance, bore any adequate relation, either to the high quality or the amount of professional work which, particularly of late years, has been crowded upon them. As a matter of fact, this salary was fixed by an act which was passed some sixty years ago; and in view of the great development which has occurred in the interval in the arts and sciences, it is really astonishing that an increase should have been so long delayed. To become a competent Patent Office examiner calls for a wide range of knowledge and the possession of unusual mental qualifications. The examiners are supposed to be graduates of colleges or technical schools, well grounded in physics, chemistry, higher mathematics, technics, French, German, and in the reading and describing of mechanical drawings. Hence, it is not surprising that a large percentage of those who have been appointed, and whose salary has ranged from $1,200 a year at the start to a maximum possible salary of $2,500 a year, have looked upon their period of service in the Patent Office merely as a stepping stone to independent professional practice.

Under the recent appropriation, the salary of the Commissioner of Patents has been increased from forty-five hundred to five thousand dollars a year, and the Assistant Commissioner's salary from three thousand to three thousand five hundred a year. The Chief Clerk, who shall be qualified to act as a principal examiner, is to receive three thousand dollars as against twenty-five hundred dollars a year. The salary of the forty-two principal examiners is raised from twenty-five hundred to twenty-seven hundred dollars, and that of the fifty-eight first assistant examiners from eighteen hundred dollars a year to twenty-four hundred dollars. Proportional increases are made in the salaries of the other members of the staff. We believe that the effect of this more liberal attitude of Congress will be to induce a more competent class of men to apply for admission to the Patent Office, and that it will check the steadily increasing number of resignations, which have amounted to nearly fifty per cent of the examining corps in a period of less than five years.

IMPROVEMENT OF NEW JERSEY-NEW YORK SUBURBAN SERVICE.—I.

LACKAWANNA RAILROAD.

The phenomenal growth in recent years of the suburban railroad service of New York city has made it imperative for the railroads to carry through important improvements and enlargements, both of their lines and terminals, in order to meet the situation. Particularly has the increase in the traffic, and the growth in importance of the towns through which the railroads pass, necessitated the abolition of grade crossings—a requirement which, in itself, has proved sufficient to entail an enormous amount of reconstruction of the tracks.

It is the purpose of the present series of articles to deal more particularly with the railroads in New Jersey, which have their termini on the western shore of the Hudson River. Conspicuous among these, both in the magnitude of its freight and passenger service, and in the extent and costliness of the work of reconstruction, is the Delaware, Lackawanna & Western Railroad, whose terminus is in Hoboken. So great has been the growth of traffic on this road, that its suburban service alone has more than doubled in the past nine years. The improvements of the road, which have been continuously under way for a period of seven or eight years, include the construction of new ferry slips and a large terminal station and offices, the entire rearrangement of the terminal yard, the construction of a new two-track tunnel through Bergen Hill, the elimination of grade crossings in Harrison, Newark, and Summit, N. J., the removal of old bridges, built when trains and locomotives were much lighter than now, and the erection, in their place, of modern bridges built up to the specifications for the heavy standard rolling stock of the day.

The new terminal station, which is built of the most approved fireproof construction, is served by three different lines of ferry service, one from Barclay Street, another from Christopher Street, and the third from Twenty-third Street. The ferry boats, from designs by William Gardner, the well-known naval architect, are probably the fastest on the North River. They enter and leave from six new slips, two of which are reserved for the use of each line. From the ferries, passengers are landed upon a two-deck concourse, the upper floor of which has a clear length of nearly 500 feet and a width of 60 feet. Beyond the concourse is the waiting room, and to the left of it is an exceedingly handsome dining room, whose windows command a view of the Hudson River and Manhattan Island. The train shed is perhaps the most interesting feature of this terminal; it is built from designs of the chief engineer, Mr. L. Bush, and is designed to take the place of the great arched glass roofs of wide span which were formerly so popular, and avoid the excessive costs of construction and maintenance and the objections of heat, smoke, and disfigurement which are inseparable from that type. The Lackawanna train shed, which is 350 feet in width by 600 feet in length, has a capacity for 163 cars. It is covered by a low glass, steel, and concrete roof, which is carried upon lines of tastefully designed cast-iron columns, extending down the center of each platform. The cross section of the station roof shows a series of graceful elliptical steel arches, springing from the lines of columns, and each spanning a pair of tracks. Immediately above the center line of each track a longitudinal channelway or opening is cut through the roof, and serves to allow the smoke and steam of the exhaust from the locomotives to pass directly clear of the station. This opening is built of concrete, and where the roof arches pass across it, they are heavily incased in concrete. This method of construction has the double advantage that not only is the exhaust carried immediately clear of the station, but it has the effect of creating an induced draft which ventilates the station very effectually. A series of comparative tests taken on the same days, of the Lackawanna train shed and the great arched train shed of the Pennsylvania Railroad at Jersey City showed the Bush type of shed to be from three to five degrees cooler.

The train yard beyond the station has been entirely revised, and the layout of the tracks has been so adjusted that it is practically impossible for a delayed or broken-down train to block exit from the station, there being always a choice of alternative tracks.

The most important improvement, naturally, is the doubling of the tunnel through Bergen Hill. The old tunnel, which provided for two tracks, was a brick-

lined structure 27 feet wide and 19½ feet in height, with an elliptical roof. The provision for ventilation was inadequate, and it is needless to say that the two tracks which it contained were quite unable to take care of the rapidly-growing traffic. The new tunnel runs through the hill parallel with the old tunnel and at the same grade. There is a partition wall 23 feet thick between the two, 19 feet of which consists of the native rock, and 4 feet is the thickness of the combined tunnel linings. The total length of the new tunnel is 4,280 feet; it is 3 feet wider than the old tunnel, or 30 feet in the clear. The roof is semicircular, and struck to a 15-foot radius, and the height from rail base to crown is 23½ feet, or 4 feet more than that of the old tunnel. In driving the new tunnel, it was determined to make ample provision for ventilation of both tunnels; and to this end, two open cuts were made and three shafts were driven from the top of the hill down to the tunnel, thus providing five equally spaced openings in all. The shafts measure 10 feet by 30 feet in section, and the open cuts are 80 feet wide, or wide enough to include both tunnels, and 100 feet in length, measured in the direction of the tracks. By means of the shafts and open cuts, it became possible to attack the work of excavation from twelve different points. The material encountered consisted of a trap rock, most of which was exceedingly hard. The excavation work commenced in March, 1906, and was completed May 16, 1908. It involved the removal of 125,000 yards of trap-rock material.

Immediately beyond the western portal of the tunnel, the tracks cross those of the Susquehanna Railroad at grade, and it is proposed to eliminate this crossing by depressing the Susquehanna tracks 10½ feet, and elevating those of the Lackawanna Railway by a similar amount, on both the Boonton branch and the Morris & Essex line. It should be mentioned here that, with a view to expediting traffic during the rush hours of the morning and evening, it is proposed to utilize three of the four tunnel tracks during those periods of the day for incoming or outgoing traffic, reserving the fourth track for traffic in the opposite direction. Thus, in the morning when there are many more passenger trains running into the terminal than out, three east-bound tunnel tracks will be reserved for east-bound traffic, the fourth to be used for the west-bound; and in the evening three west-bound tracks will be reserved for west-bound traffic and one for the east-bound traffic.

The terminal reconstruction work as outlined above, however, is but a portion of the work that has been done on these lines. In the SCIENTIFIC AMERICAN of January 2, 1904, we published an illustrated article describing, in considerable detail, the work of reconstruction as carried out on the line from the Jersey meadows to Summit, N. J. The most important section of this work consisted of the reconstruction of the line from Harrison through Newark to East Orange, a distance of three miles. The tracks originally ran through Newark at street grade, and after crossing the Passaic River, the road climbed the hill to the west of the river on a heavy grade of 138 feet to the mile. The reconstruction included the reduction of this grade to a maximum of 60 feet to the mile, and the elevation of the tracks above street grade through Newark, where no less than twenty-seven grade crossings were eliminated, the streets now passing below the tracks. Every grade crossing in that city has now been eliminated. It should also be mentioned that new crossings have been built over both the Hackensack and the Passaic rivers, both of which important works were carried through without any serious interference with the traffic. A similar elevation and depression of the tracks has been made at Summit, where twenty grade crossings have been eliminated; and when the whole work has been completed, all the grade crossings between Harrison and Morristown, a distance of thirty miles, will have been abolished, the grades and curvature eased and reduced.

The improvement in the Lackawanna suburban service, resulting from these important works, has been enhanced by the construction of the Hudson tunnels, whose terminal station is located at the entrance to the Lackawanna terminal. Passengers arriving at Hoboken can board the tunnel trains, and in a few minutes find themselves in the heart of the shopping district. Ultimately, when the down-town tunnels are completed, a brief run will carry them to the heart of the financial district, landing them at the Cortlandt Street terminal. The Lackawanna terminal work and, indeed, all of the reconstruction, has been successfully carried out under Mr. Lincoln Bush as chief engineer.

There were in Spain in 1901 only 861 electric power stations, of which 651 were for public lighting and 210 for private lighting. Since then the number of power stations for electric lighting has increased considerably, and it may be added also that the use of electricity in its many other applications has also increased and become more general, but there is still a vast field for further industrial developments, as the supply of power which the country affords is yet far from being exhausted.

THE AUTOGENOUS SOLDERING OF ALUMINIUM IN AERONAUTIC CONSTRUCTION.

Since the time when aluminium and its alloys became known as non-corrosive, inexpensive, and specifically very light metals, it seemed natural to consider their use in dirigible balloons and flying machines. An experience of fifteen years had pointed to the fact that the durability of aluminium is generally directly proportional to its purity, and the factories, taking advantage of this fact, have already been furnishing for a number of years a product that at the most does not contain more than from 1 to 2 per cent of impurities, so that there are no longer scarcely any objections on this point. Such as there are could only exist as long as the aluminium parts were exposed intermittently or continuously to immersion in water, while with the different aluminium alloys, such as wolfraluminmagnalium, partinium, etc., decomposition, or rather oxidation, in the air would take place only to a very insignificant and practically negligible degree.

The possible uses of aluminium and its alloys in aerial navigation in the shape of rods, sheets, or castings are numerous and the following enumeration of them does not claim to be complete. Some of these uses are the replacing of the gold beaters' skin of experimental captive balloons with registering instruments by welded aluminium foil; air propellers; radiators for motors; carbureters; horizontal rudders of welded 2/10 millimeter aluminium sheeting; valves, cars, or body frameworks; gasoline tanks.

With the monoplane and biplane fliers the material for the carrying surfaces may also advantageously consist of aluminium. In fact it could even be imagined that in certain cases, such as the dirigible balloon type with rigid internal framing (like the Von Zeppelin airship) the expensive rubberized silk fabric could be replaced by aluminium sheeting, the toughness and ductility of which render it most suitable for the purpose. Aluminium sheeting may be rolled out to the thinness of paper without even losing its absolute impermeability to hydrogen; and by means of the Schoop* process for the autogenous welding of this metal (see SCIENTIFIC AMERICAN of March 2, 1907), any number of joints may be quickly made in an absolutely irreproachable and reliable manner. In view of the fact that very little about this invention is as yet known in aeronautical circles, we give briefly some authentic data on this novel welding process. These data should be all the more acceptable, as everything under the head of aluminium soldering is received with an unmistakable and mostly also a well-deserved distrust.

Where there is light there is shadow. So also the silvery white clay-descended "metal of the future," besides its many undisputed virtues, has one very marked weakness. It is possessed of a well-nigh pathological incompatibility toward other metals, and shows this distinctly, especially in water, by the fact that it causes, in the presence of ever so small quantities of zinc, iron, etc., a "galvanic local action" to take place and slowly decomposes with a steady discharge of small hydrogen bubbles. If a *soldered* piece of aluminium is put in water that has been made conductive by a few drops of muriatic acid, this electrolysis is directly visible to the naked eye. However, this sensitiveness of aluminium toward other metals and the unreliability of soldered aluminium joints has been known for a long while to all who work with this metal and obviously is to be connected with the fact that among all the many patented and unpatented proposals not a single process has succeeded in entering into general practice. Consequently, up to the last few years one had to resort to different working methods, as pressing, stamping, riveting, folding, etc.

The solution of the problem—the absolutely certain, durable, and hermetical joining of two aluminium pieces by means of heating—could be brought about only by autogenous soldering, or rather welding, or more exactly still, fusing, when aluminium is bound directly to aluminium without interposing another metal or alloy with a comparatively low melting point. The majority of the metals do not offer any difficulties to this joining process by means of the hot oxygen flame, and especially during the past years the autogenous welding of lead, iron, and copper has attained an unexpected importance and development in Germany, France, and Belgium. But while with lead or iron the film of oxide is removed by the reducing action of the flame, with aluminium a chemical solvent† has to be employed to play the role of borax in hard-soldering.

With the help of this oxide-reducing flux, which is in the form of a paste, a very thin layer of which is put on the aluminium parts to be joined together, the welding is effected very speedily and homogeneously, while the resulting places of fusion, as will be seen at once, will show physically and chemically exactly the condition of the normal, unfused aluminium. No alterations can ever occur in such weldings from the forming of a galvanic circuit in the presence of moisture or of water; or, in other words, the welded seams will preserve once for all their initial strength, as is confirmed not only by experiments in official testing institutions for materials (Laboratoire d'Essais du Conservatoire des Arts et Métiers in Paris, and Edgen.Materialprüfungsanstalt in Zurich), but also by practical tests of durability.

Which gas combination should be used, whether hydrogen-oxygen or acetylene-oxygen, is unimportant; the principal point is to have a hot concentrated flame suitable for local heating. For sheetings thinner than 2 millimeters the hydrogen-oxygen or coal gas-oxygen flame will generally serve best, while welding thick sheets or castings will most rationally be done with the oxy-acetylene flame. The temperature reached is here so high, namely 5,000 deg. C. (9,032 deg. F.) that aluminium will be melted almost instantaneously, like butter. The melting point of aluminium is reached at 650 deg. C. (1,202 deg. F.), but the heat conduction is so intense from the places struck by the flame, that in practice much higher temperatures are imperative.

So it will be understood that the hydrogen-air flame with its nitrogen ballast, the temperature of which is but 1,650 deg. C. (3,002 deg. F.) is already insufficient for sheets of over one millimeter in thickness.

Ordinary plumbers' torches are totally unfit for this use, as the gasoline-air flame of these issues in the form of a broad, voluminous cone from the orifice and precludes any even half-way localized heating of the places to be welded.

Aluminium wires, however, may easily be welded even with this primitive implement.

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* The patent rights of this process are held by the Actien Gesellschaft für Autogene Aluminiumschweissung (stock company for autogenous aluminium welding) in Zurich.

† Compare also: M. U. Schoop: "The Autogenous Soldering of Aluminium," Chemiker Zeitung, Cöthen, 1907.

A NEW BALLOON MATERIAL.

A new balloon fabric which is very similar to the continental balloon material that has been found so successful in Germany has been put on the market in this country. This fabric is made up of seven thin layers of rubber weighing 5 ounces per square yard, which are placed between two layers of fine silk weighing about 2½ ounces per square yard. The silk and rubber are thoroughly vulcanized together, the result being that the material thus formed will stand a strain of 100 pounds per inch width. Notwithstanding it is very elastic, it offers other advantages in that it is absolutely moisture and gas proof. The tests of a similar material in Germany have shown that balloons constructed of this fabric will not lose half of one per cent of the gas they contain in six weeks time, while such balloons are much more durable, their life being about five times as long. Heat and cold have no effect upon this material. It will stand 80 degrees more heat than a varnished silk balloon before it begins to blister, and it will stand a temperature below the freezing point without any trouble whatever, whereas the ordinary balloon will not stand a temperature of less than 40 degrees. The difficulties encountered with an ordinary balloon, such as the sticking of the folds when such a balloon is deflated and folded up in a moist state, and also the danger from spontaneous combustion under such circumstances, are entirely done away with. The new material can be patched very readily, if necessary. Manufacturers supply it in any weight, width, or color desired. The price is rather high, being about $2.50 per square yard, but durability and other advantages more than offset this.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1694, has "The Manufacture of Fresh-Water Pearl Buttons" as the title article. "Friction of the Air" is by Major Baden-Powell. "Automatic Cab-signaling on Locomotives" treats of an ingenious system. "Rust and Mildew" causes an annual loss in the United States of $500,000,000 yearly. "Bread" is a scientific discussion of the staff of life. "Dr. Schlick's Gyroscopic Apparatus for Preventing Ships from Rolling" is an interesting article and is fully illustrated. "Modern Theories of Electricity and Matter" is by Madame Curie. The usual notes will be found in their accustomed places.

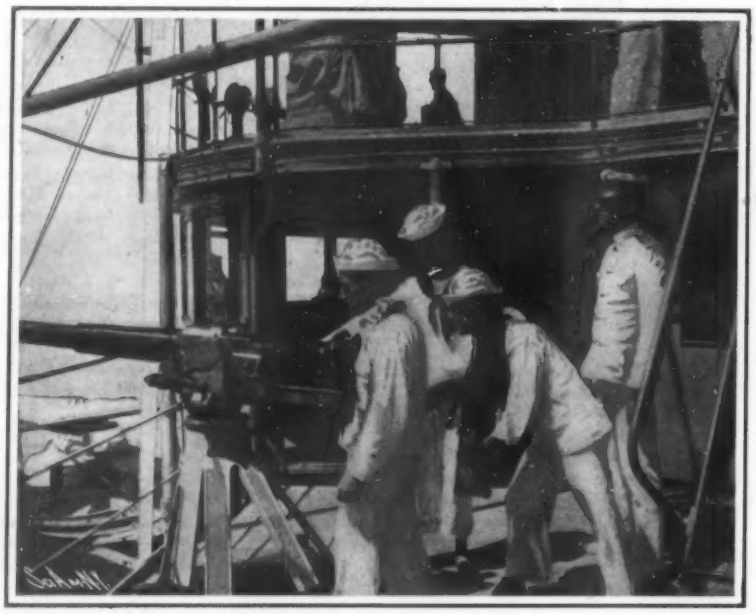
It is a common practice when supplying customers with current for power and lighting purposes from three-phase mains to give a proper three-phase three-wire supply for the motors and a separate two-wire supply for the lamps—each supply being separately metered. M. C. Herz, in La Lumière Electrique, points out that under the circumstances it is possible, with certain conditions, for the power meter to fail to act and the light meter to run in the reverse direction. The action is the result of the motors taking a heavy lagging current, and is analogous to the well-known difference in amount of power registered by the two meters used in the ordinary way for measuring a three-phase supply by the two-wattmeter method.

TRAINING IN THE NAVY.

BY JOHN R. COX.

In the old days of the navy, when about the only requirement of men in the fo'castle was a knowledge of sailoring, the service was recruited almost exclusively from the seafaring class. It was not essential that a man have any other qualifications for naval duty than to know how to "let go and haul," man a boat, and steer. It was not necessary for him to be an American citizen; in fact, usually he was not.

With the advent of modern naval construction, however, the demand arose for an entirely different class of men; seamanship was subordinated to machinery and electricity. Nowadays a man must be an American citizen, native or naturalized. He must, besides, furnish satisfactory evidence that he is of good moral character; but it is not necessary for him to have any knowledge of the sea—that is all taught him after he enlists.



Practice With a Rapid-Fire Gun.

The crew of a battleship is composed of men with a great variety of trades, the larger portion of which are in the seaman branch. In order to train men for the duties required of them, the Navy Department has established three large training stations. They are located on Coasters' Harbor Island, in Newport Harbor, R. I.; at Norfolk, Va.; and on Yerba Buena Island, in San Francisco Bay. These stations receive young men between seventeen and twenty-five years of age, who enter the navy as "apprentice seamen." Recruits are first assigned to the "newcomers' squad," and are quartered in a separate building, where they receive close supervision at the start and are taught the necessity for naval discipline, regular habits, and implicit obedience to the orders of their superiors. They are also instructed in the method of keeping their uniforms and persons neat and clean, ready for inspection at all times; they learn how to swim, if they do not already know how, swimming pools being provided indoors for winter months, with facilities for heating the water, and precautions taken to prevent accident.

The apprentice seaman is then assigned to a company or division, and he is soon able to master the various drills or evolutions. These drills consist of infantry tactics, setting-up exercises, riot formation, as well as artillery drill. He learns how to "box the compass" by means of a large painted reproduction of a compass on the walls; he acquires a knowledge of signaling, and a familiarity with the flags of all nations and international signal flags; he learns how to heave the lead, the use of the log, how to tie knots, splice ropes, make hitches and bowlines, and is given general instruction in old-time seamanship in the rigging aloft. Later he is assigned to one of the yachts or small training ships attached to the station, for a cruise of a week or two in inland waters, where he puts into practice the knowledge he has acquired at the station, and has a turn at the wheel. This brief experience on board ship teaches him also how to sling his hammock, and usually gives him his "sea legs," so that later, when he completes the course and goes on board a battleship, he is less apt to be seasick. During all the period his physical well-being is carefully looked after; calisthenic drills or setting-up exercises are held every day, and he has besides the benefit of a well-equipped gymnasium. The hours of duty and instruction are not long, and ample time is allowed each day for outdoor athletics if the weather permits, and for reading and study.

The commissary department is one of the most important features of the station. Men are given three good, plain, appetizing meals a day, besides coffee or cocoa in the early morning. The bugle sounds at 5:30 A. M., and the boys tumble out promptly and lash their hammocks. After a bowl of hot cocoa or coffee comes an hour of scrubbing up; not only of clothing, but hammocks, covers, hammock bags, etc., which must all be cleaned, dried, and aired. At 8 o'clock they fall in for breakfast; after which there are quarters and prayers. From about 9 until noon the time is given over to study or instruction. After dinner the instruction continues until 3 or 4, after which time until taps are sounded at 9 the apprentice seaman is free to do as he pleases.

In addition to the training stations for the instruction of apprentice seamen, the navy maintains schools for electricians, machinists, artificers, yeomen (who form the clerical force of the navy), seamen gunners, the hospital corps, and cooks and bakers. Recruits are received at all these schools direct from civil life, as well as from men in lower ratings already in the service. At each school a most complete course of instruction is given, which fits the men for the duties which will later be required of them on board ship; but it also prepares them for following their trade in civil life, should they decide not to return to the service after their enlistment. The navy aims to make its training so thorough that every man who leaves any one of its schools is competent to perform the duties of his trade. It receives boys with no previous training of any kind, develops their physique, hardens their muscles, broadens their chests, gives them a technical education, and offers them permanent occupation at a fair rate of pay at the start, with advancement in pay and position as fast as they become qualified.

Men who complete the instruction at the training station are rated ordinary seamen, at $19 a month, or coal passer, $22. The higher ratings of the seaman branch are: Seamen, $24; and $30, $35, and $40 for petty officers third, second, and first class. In the engine room the ratings are: Fireman, $30 and $35; oiler, $37; water tender, $40; plumber and fitter, $45; blacksmith and chief water tender, $50; coppersmith, $55; and boilermaker, $65.

The artificer and special branches have four classes of petty officers, with pay corresponding to the classification in the seaman branch. Ship's cooks are paid $55, $40, $30, and $25, while bakers receive $45 and $35. The hospital corps consists of three ratings, paying $60, $30, and $20.

The bluejacket must pay for his uniform after the initial outfit, but he gets it at actual cost. He is also required to purchase certain "small stores," pay his barber bill, and keep his clothes clean. The necessary alterations to his uniform are made free of charge by the ship's tailor. It is customary for the chief petty officers' mess to contribute a small monthly sum for the purchase of delicacies not on the navy ration. Other than these, the expenditures of an enlisted man are voluntary.

Besides the regular pay and allowances for re-enlistment, continuous service, and good conduct, there are compensations for certain duties and for expertness. For instance: Coxswains of steam launches receive $5 a month; crew messmen and jacks-of-the-dust (the paymaster's "striker") are also allowed $5; signalmen get $3, $2, and $1 additional; the crew of a submarine are paid an extra $5 a month, besides a dollar a day for each day the boat is submerged; gun pointers draw a bonus of $2 to $10, depending on the size of the gun; money prizes are also offered for skill at target practice. Ship's tailors are paid for their extra duty $15 and $20, while the tailor's helper has $10 added to the pay of his rating.

A chief petty officer, after one year's service on board a man-of-war, receives $70 a month. To this should be added allowances for continuous service, good conduct medals, and re-enlistment money, which in two enlistments would amount to $11.47 a month. When it is remembered that his board, lodging, medical attendance, hospital care if sick, street-car fare, and traveling expenses cost him nothing, it will be seen that this pay compares very favorably with like occupation in civil life. It is possible for a man to attain the rating of chief petty officer within one enlistment of four years; and if he does not do so within eight years, he lacks the qualities for succeeding in any occupation.

But he need not stop with the highest enlisted rank. After seven years' continuous service he can apply for a warrant, an intermediate rank between a chief petty officer and a commissioned officer. The pay ranges from $1,200 to $1,800 a year with an allowance for rations and commutation of quarters, which increases it by $200 to $300. There is also a chance for exceptional men to attain a commission, the examination being limited to warrant officers with four years' service. To pass this examination means hard work, study, and faithful devotion to duty; but since the law authorizing the promotion of men from the ranks to commissioned grade was passed in 1901, a considerable number of the candidates have each year attained the rank of ensign.

The Officer of the Deck.

It is Not All Hard Work in the Navy.

TRAINING IN THE NAVY.

NEW ELECTRICAL APPARATUS OF THE UNITED STATES SIGNAL CORPS.

BY C. H. CLAUDY.

In accordance with acts of Congress in recent years, the coast defenses of the United States have been materially improved and strengthened. In no particular has more progress been made than in the electrical devices by which the fire from heavy guns is directed and controlled by the various artillery officers who constitute the chain of command in artillery districts.

It is the duty of the Signal Corps to furnish the devices which are required, and this corps has been very busy developing the necessary special apparatus. Much has also been done toward perfecting various means of communication between bodies of men in the field; but the electrical equipment for artillery fire control and direction claims first interest. Of the various electrical systems employed, the telephones to and from the gun, to the range-finding station, and the various artillery commanders, the electrical circuits for doing the thousand and one things in connection with a coast defense system, can be but mentioned in a story of the length of this one. The most striking application of electricity in this connection is the use of the telautograph, which, as most people know, is an instrument for sending and reproducing a written message. The operator writes on a roll of paper with a pencil, especially provided, and a mechanical pen at the other end of the line reproduces the message in the very handwriting of the sender.

The modern coast defense gun may be fired without the gunner having any idea as to what he is shooting at, or in any way "sighting" his gun. In days gone by, and so late as the civil war, gunners trained their guns as a markman aims his rifle—allowed so much for wind, so much for elevation, and so much for movement of the object, as experience, intuition, and judgment dictated. But now the great size and range of the guns render it imperative that the system be scientific.

Ranges are obtained now with range-finding instruments, all working on the parallax principle; that is, two sights or more are taken from two or more different points, the angle graphically calculated, and the exact distance and azimuth of the object thus ascertained. Ready tables carefully computed show all the corrections at a glance, and wind and tide (in sea shooting to be factored on account of elevation), wind azimuth, speed of object, etc., all enter into the calculation with mathematical accuracy. Such a corrected range, now obtained in a few seconds, is communicated to the gunners, who train their gun according to the range given them, and fire at a signal. Other things being equal, the shot, correctly calculated, strikes home. About ninety per cent of hits is the average in coast defense practice. Some causes of misses may be inaccuracy of calculation, inaccuracy of charge, explosive not working as it should, more or less wind at time of shot than during calculation, and such factors which cannot be entirely eliminated.

It costs a great deal of money to fire a big coast defense gun, and a miss may mean not only a waste of capital, but a waste of opportunity. A single shot has before now decided a battle. Consequently, there must be no possibility of mistake that can be avoided; hence, not only is the range communicated to the gunner through a telephone clamped to his ear by a head band, but the telautograph is used as well to put the figures before the gunner's eyes.

The writing pencil of the telautograph is connected with two flexible jointed arms, controlling two rheostats. These rheostats in turn control electric currents which, according to their strength, actuate in a greater or less degree two suspended solenoids which are pulled, more or less strongly, into tubular electromagnets. These solenoids, by similar jointed flexible arms, control a pen, which traces on the paper of the recording instrument the message as it is written.

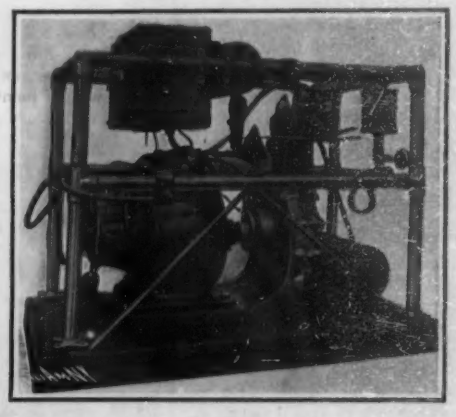
The sending pencil cannot be moved without moving the rheostat controller on at least one side of the instrument, and in most movements without moving both. The controllers cannot move without altering the currents, and the currents when altered must affect the solenoids, and hence the recording pen. The pen must be inked. Consequently, before a message can be sent, a button must be pressed by the sender, and it can only be pressed by the sending pencil. This button occupies the same position relative to the writing space that the ink bottle does to the recording writ-

Portable Wireless Telegraph Station in Use in Cuba.

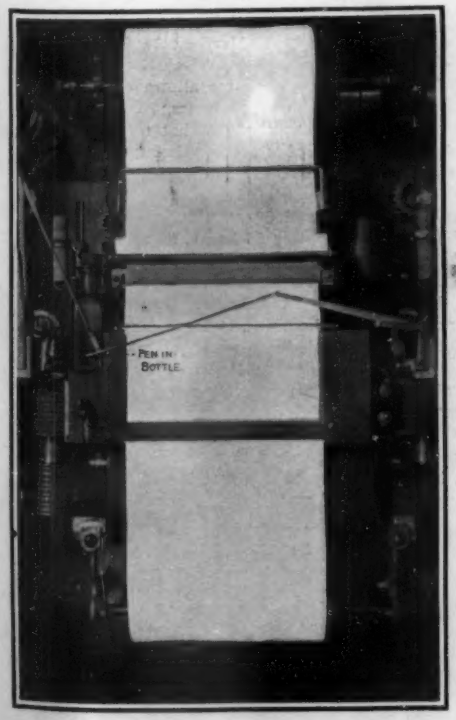
Portable Field Buzzer with Reel.

Portable Field Telephone Switchboard.

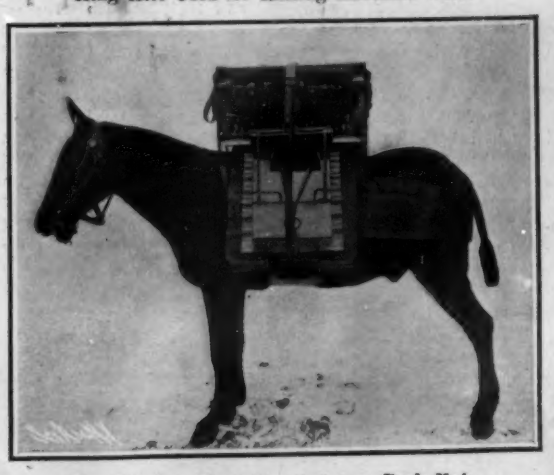
King Kite Used for Raising Antennæ Wire.



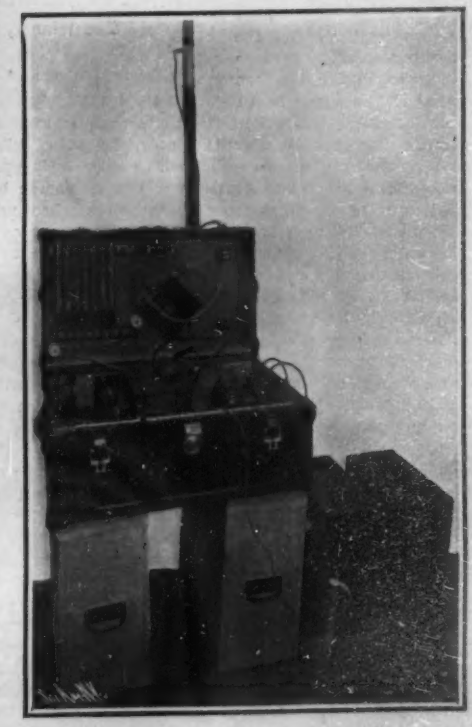
Portable Generator for Charging Storage Batteries.



Telautograph Used for Transmitting Gun Ranges.



The Wireless Chest Mounted on a Pack Mule.



Field Wireless Set Ready for Operation.

NEW ELECTRICAL APPARATUS OF THE UNITED STATES SIGNAL CORPS.

ing space. So when the button is pressed with the recording pencil, the pen in the recording instrument jams itself into the ink bottle and is inked. A buzzer is included in the outfit, which keeps the parts slightly a-tremble, thus making the pen glide smoothly over roughnesses in the paper and tending to make the ink flow freely.

It is a curious sight to see in the laboratory of the Signal Corps in Washington a demonstration of this outfit. The experimenter presses the button, pulls a small lever, and writes, "R. 7890 A 220.38," or some similar combination of numbers and letters representing a range. On the other side of the room a lamp lights, a slight buzzing is heard, and beneath a glass window a pen dips into an ink bottle and beneath it on a roll of paper, appears in the handwriting of the sender, "R. 7890 A 220.38." The gunner thus has the range and azimuth written and spoken, and except for the personal equation always present there is no chance for a mistake. He may be deaf for the moment, or his attention distracted, but hardly blind—he may fail to see, but hardly to hear too, at the same instant. The range is where it belongs, the gun is trained, with the fifteen seconds of allowance for the path of the moving ship, the signal comes "Fire!" and another shell screams on its way to the vitals of the ship which has the temerity to attack such a system.

These telautographs are in use or being installed at Sandy Hook, Fortress Monroe (Hampton Roads), Fort Wadsworth, Fort Hamilton, Boston, Portland, Me., and will be shortly at San Francisco, and possibly in other places.

Possibly the most interesting production of the Signal Corps for field use is the new portable wireless telegraph station, which can be carried on mule back, and sent out with a scouting party, keeping it in touch with the main body for a distance of from fifteen to twenty-five miles, or which may be used for connecting armies or divisions. These outfits are extremely compact, and are supplied with power from two storage batteries or from other portable means. These batteries have a maximum output of ten hours' actual sending. It would seem that campaigning in the field is a poor place to get a battery recharged, but the portable generator and gasoline engine illustrated herewith solve the problem. This outfit weighs less than three hundred and fifty pounds, and must of course be carried in a wagon; but as all large bodies of troops must have supply trains, and as supply trains must have wagons and roads, the charging station can go wherever a division can go. And the parties sent out with the traveling equipment and the storage batteries must send in after a few days for supplies, when they can get new batteries or take out the old ones recharged. The portable generating station of two horse-power can of course be used to send messages from headquarters when not engaged in charging batteries. The antennæ are carried on a sixty-foot pole, which is in ten sections and which makes its own connections, section to section, as it is fitted together.

Field experiments with this outfit have demonstrated that not infrequently messages can be sent over a distance of twenty-five miles. Communication with a large station, such as that at Cape Henry, Sandy Hook, or Key West, can be maintained over a distance of one hundred and twenty miles.

But the wireless in portable form, useful as it is, is not designed to displace the other and older forms of apparatus. There is here illustrated a portable telephone switchboard, designed for camps or headquarters, and connecting various departments. The hospital, the kitchen, the stables, the storage-wagon station, etc., can each and all be connected with headquarters by wires put up in a hurry and adapted for only temporary use; and this portable switchboard, which a man can carry on his back, will take care of the service and connect each to another or any one to headquarters. Doing business thus direct instead of by telegraph or dispatch bearer cannot but expedite the slowest camp.

Most wonderful of all the intercommunicating devices, however, is the field buzzer—an English invention, but neglected by its mother country and taken up and improved by our own Signal Corps until it is a practical and efficient instrument. The apparatus may be used for transmitting telegraphic as well as telephonic messages. The power is supplied from five tiny dry batteries, all of which can be easily carried in two hands.

The buzzer proper consists of a small vibrating hammer like the interrupter of an induction coil, and operated in the same way, and this makes a buzzing noise of a high pitch, hence the name. The high-frequency induced current has the faculty of finding its way across breaks and over leaks that would render totally inoperative the ordinary telegraphic devices, and finding its way to a circuit. Practically the only way of interrupting the operation of this instrument, within the limits of its range, is by making a number of gaps in the line. When the ground or foliage, or whatever the wire rests upon, is too dry, and the breaks too many for its power, the instrument of course refuses to work.

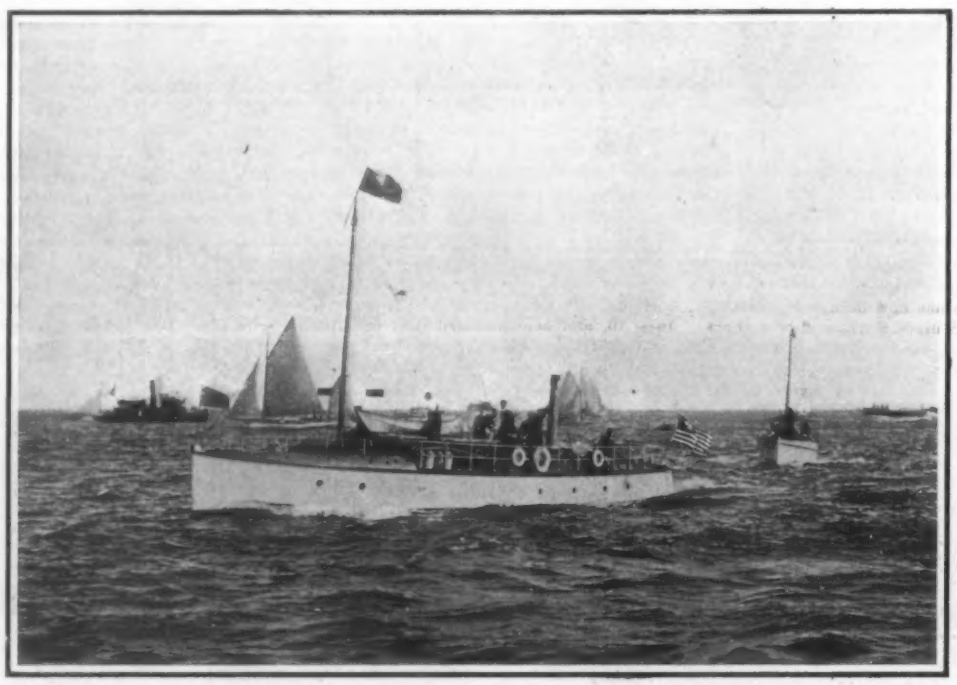
The principle of the buzzer is found in the sensitive action of the telephone receiver as a detecter for feeble momentary currents and the comparatively high voltage developed at the terminals of an electromagnet when the current is suddenly interrupted.

The practical application of this outfit is obvious. A scouting party of one man, for instance, wishes to go forth and send back his information immediately. He gets on a horse, and holds in his hand a reel, carrying others in his saddle-bags. As fast as his horse can gallop, this stranded wire, two threads of copper and one of steel, for strength, is paid out. It falls on the ground, in the water, anywhere, it makes little difference. He finds out what he wishes to know, and goes to his little instrument and telephones. In the middle of his speech a wagon runs across his wires and cuts them. Speech stops, but the buzzer continues working. The enemy may see the wire and cut it, but it will probably make no difference, for a large part of the high-frequency current will leak across the gap and continue to the receiver.

The wire can be taken up by the same man with a swiftly-revolving intake reel, or can be abandoned. Ten miles of wire weighs but one hundred and forty pounds, and a ten-mile length is easily operated by the small batteries carried, even if the wire is cut or broken in several places.

In Lawton's advance through central Luzon, communication was constantly maintained with the buzzer between Cabanatuan, head of navigation on the Rio Grande, and San Jose, thirty miles north. Ten miles of the line was imperfectly insulated, and twenty miles was bare wire laid in earth, on trees, and over bushes. Part of the time heavy rains fell, which so flooded rivers as to prevent personal communication. In spite of these almost prohibitive conditions, the buzzer operated, faintly, it is true, but its signals were readable, and that was all that was required.

Henry Lemoine has not succeeded in producing the artificial diamonds within the time limit prescribed by the court. An extension of time until June 17 has been granted.



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The Winner, the "Ailsa Craig," in the Foreground and the "Irene II" in the Distance.

COMPETING MOTOR BOATS IN THE RACE TO BERMUDA.

THE MOTOR-BOAT RACE TO BERMUDA.

In the motor-boat race to Bermuda this year there were but two competing craft—the "Ailsa Craig" of James Craig and the "Irene II" of S. W. Granbery. The former of these two boats ran in the race last year, and as a result of the trip, it had received some improvements, such as the fitting of a ventilator pipe for the engine room, etc. The latter boat, however, made its maiden voyage. This boat was launched only a few days before the race, and was hurriedly fitted with engine and equipment. In view of this fact, and also in view of the fact that the voyage was a rather rough one, the showing made by the "Irene II" was very good. Had its navigating officer been able to find his longitude, this boat would probably have won the race, as, although the gasoline feed pipe was broken by the heavy rolling of the boat a few hours before the finish, the crew managed to supply the engine with fuel from a tea cup and thus keep it running.

Our illustration shows the two boats just before the start. The "Ailsa Craig," which is shown in the foreground, has an over-all length of 59 feet 8½ inches. Its length on the load waterline is half an inch less, while its beam is 9 feet 8¾ inches and the draft 5 feet 3 inches. The midship section is 20 square feet. The engine used is a four-cylinder Craig marine motor, rated at 61½ horse-power, and the bore and stroke of the cylinders are respectively 9 and 10 inches.

The "Irene II," which is also shown in the picture, has an over-all length of 39 feet 11 inches and a load waterline length of 38 feet 8 inches. The beam is 10 feet and the draft 3 feet 3 inches. The midship section of this boat is 19.66 square feet. Its motive power consists of a three-cylinder Standard motor rated at 16.13 horse-power and having a bore and stroke of 6 and 8 inches respectively.

The race was started off Norton's Point, Coney Island, at 4:35 P. M.—on Saturday, June 6. The "Irene II" crossed the line ten seconds later, and the "Craig" at 4:35:30. Ten minutes later the "Craig" had overhauled and passed the "Irene II," and in two hours' time she had gained so much that the latter boat was lost to view. The distance covered by the "Craig" up to noon of the second day was 190 nautical miles, while during the next day's run in the Gulf Stream, 248 nautical miles were covered. The total distance to Bermuda was 670 nautical miles, or 772.37 statute miles; and the "Ailsa Craig," despite rough seas and strong head winds, covered the distance in 66½ hours, arriving off St. David's Head at 11:45 A. M. (or 11 o'clock New York time) on Tuesday, June 9. The time allowance which was given the "Irene II" was 20 hours, 23 minutes, and 24 seconds, and it was thought that this boat would stand a good chance of winning. Owing to the causes mentioned above, however, she did not finish until four hours later than the time allowed her, or in 90 hours, 39 minutes, and 50 seconds. The actual time of the "Ailsa Craig" was 66 hours, 30 minutes, and 40 seconds. This corresponds to a speed of 10.07 knots, or 11.64 statute miles an hour. In last year's race this boat averaged 10.34 knots. The speed of the "Irene II" was 7.39 knots, or 8.52 statute miles an hour.

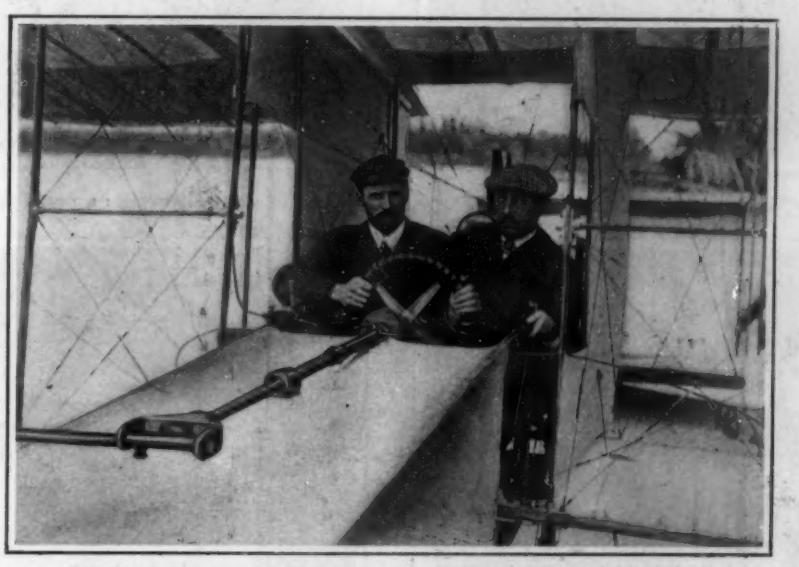
This race, although there were but two competitors, was an interesting one, as it demonstrated very well the ability of the larger cruising type of motor boat to make a successful ocean voyage, even when the weather conditions are not altogether favorable, as happened to be the case last year. It is to be hoped that if another race of this sort is run, there will be a larger number of competitors.

New Transatlantic Records.

In her last trip to the westward, the Cunard liner "Lusitania" covered the long route of 2,890 miles in 4 days, 20 hours and 8 minutes, at an average speed for the whole trip of 24.88 knots. Her best day's run was made from noon Sunday to noon Monday, when she covered the record distance of 641 miles. The weather was calm with light westerly winds until the last day, when the ship ran into a thunder squall succeeded by several hours of fog.

FARMAN'S AEROPLANE FLIGHTS IN BELGIUM.

On May 27 M. Farman began his experiments in Belgium. In the afternoon of that day he flew from 328 to 984 feet at a height of 10 feet above the rather rough ground of the shipyard at Ghent. He could not do much on this occasion because of a rather strong wind. The next day he made two short flights of 80 and 450 meters (262 and 1,476 feet), the second of which was executed at a height of 10 or 12 feet. After making a modification in his aeroplane in the shape of two vertical partitions connecting the main surfaces on each side of the engine and aviator, Farman tried again on May 30. As the weather was very fine and calm, he wished to make a flight with two persons on board. Accordingly he took M. Archdeacon in his aeroplane. Rising rapidly from the ground to a height of 22 feet, he covered a distance of 1,241 meters (4,072 feet) and stopped only on account of the limits of the space. Judges furnished by the Aero Club of Flanders had been spaced along the course to observe the flight, and others followed the flight in automobiles. The speed of the aeroplane was quite high on this occasion. M. Farman thus established a new record for a flight with two persons on board. Besides he won the wager of $2,400 which was made with M. Charron. On the 9th of March last, a number of aeronauts were assembled, and Santos Dumont, Farman, and Archdeacon advanced the idea that an aeroplane would soon be able to cover a kilometer when mounted by two persons. M. Charron held the contrary opinion, and laid a wager of $2,400 against $1,200 with the three aeronauts that an aeroplane with two persons on board, one of whom weighed at least 132 pounds, would not cover the kilometer distance before the 10th of March, 1909. It is only three months since that time, and this performance has now been easily accomplished. Subsequent to this flight, Farnam flew a short distance with Mlle. P. Van Pottelsberghe de la Potterie, a young Belgian woman, as passenger. This young lady is therefore the first woman to fly in a motor-driven aeroplane.



MM. Henri Farman and Earnest Archdeacon in the Former's Aeroplane.

This photograph shows how the noted aviator and his passenger were seated in the machine. The two vertical partitions between the upper and lower planes are recent additions to the machine for the purpose of keeping it from gliding down end on when it inclines sharply inward in making a turn. Besides the connection from the steering wheel to the horizontal rudder, the gasoline pressure gage and the spark advance lever are seen at Farman's elbow.

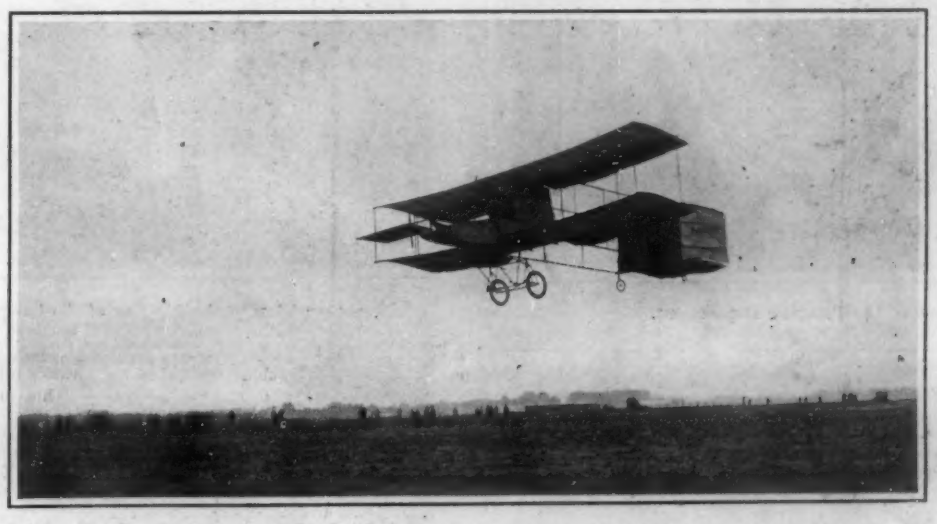
NEW FRENCH AVIATION PRIZES.

M. Armengaud has offered a new prize of $4,000 for the first aeroplane to make a half-hour flight.

M. Réné Quinton has offered a prize of $2,000 for the first aeroplane that, with its motor stopped, soars 5 minutes at a height of at least 50 meters (164 feet). In this connection it is interesting to note that Lilienthal, with his crude, bird-like glider, used to remain in the air longer than this, while Daniel Maloney, after dropping from a mile-high balloon with the Montgomery aeroplane in California, would soar for 20 minutes and land on any designated spot. Both aviators were killed from falls.

MILE FLIGHT OF THE PELTERIE AEROPLANE.

According to a cable report from Paris, on June 8 M. Robert Esnault-Pelterie made a flight of over a mile above his private aerodrome. Mr. Wilbur Wright is reported to have witnessed this flight. M. Esnault-Pelterie is a wealthy and energetic French engineer who has invented a novel 7-cylinder air-cooled aeronautic motor and an interesting monoplane, both of which we have already illustrated.



Farman's Aeroplane Making a Flight of Nearly a Mile with Two Men at Ghent, Belgium, on May 30.

Note the latest modification of this machine, which consists of two vertical partitions between the forward planes and a similar third one in the middle of the tail. One of the propeller blades can be seen beside the right front wheel.

The big rhinoceros Mogul at the Bronx Zoo has just had an operation performed for cataract. It required the services of fifteen veterinarians, 1¾ pounds of chloroform, and ½ pound of ether to reduce the animal to a proper state for the operation. The operation consumed half an hour, and it is hoped that it will prove successful. It will be a month, however, before this point can be determined.

The Beachy and Knabenshue Airship Experiments.

During the first week in June Lincoln Beachy conducted some airship experiments on Long Island. The chief of these was an attempt to control the stability of his balloon in a fore-and-aft direction by means of a bag of ballast, which could be shifted along a rope or wire of considerable length and attached to the body framework at each end. This same scheme was tried by Malecot in France last year without success, and Beachy's experiment resulted similarly. The airship pitched very badly and was well nigh uncontrollable. On June 6, however, this aeronaut made an excellent flight. He rose to a height of 1,500 feet, and remained at this altitude half an hour, describing all the while circles of a mile or more in circumference. Roy Knabenshue, at Toledo, made a successful short flight on June 10, and demonstrated that his airship, which is controlled by small aeroplanes, could be maintained in a level position or directed up or down at will. He expects shortly to make a long-distance flight from Toledo to Cleveland, O.

Automatic Cab Signaling on Locomotives.

The subject of signaling on railways is one which has engaged the attention of railroad officials for many years. The problem of giving directions to the engineer in the cab is one which appears easy to the layman, but which the practical engineer finds beset with real difficulties. Signalmen are to a certain extent checked by their fellow workers; and even if they do commit a vital mistake disastrous consequences may be avoided by the alertness and promptitude of the driver. But there is no check on the driver, who is the pivot of railroad signaling, if through any misapprehension or temporary aberration he misinterprets or ignores the signals set for him. Many devices have been tried, particularly in Europe, for obviating this weakness, but until recently none of them has proved satisfactory under test.

Delagrange's Aeroplane Flights in Italy.

M. Delagrange, the French aviator, made a sensational performance with his aeroplane at Rome on the 30th of May. He made a continuous flight of 15 minutes and 25 seconds duration, and in this time he covered a distance of 12.75 kilometers (7.92 miles). This is the longest flight which has yet been made in Europe. M. Delagrange had been in Rome for some time, but on account of the high wind which prevailed during some of his attempts, he did not succeed in flying as he expected. This brilliant performance more than makes up for the unpleasant experience of his first flights at Rome, when he was nearly mobbed by a crowd of 50,000 persons composed largely of the lower and most ignorant classes, who had, however, paid an admission fee to the grounds in order to see him fly. The successful flight was made above the Place d'Arms at 5:40 A. M. A light wind was blowing at the time. After a short run upon the ground of 300 feet or more, the aeroplane rose in the air and with great ease it made the round of the Place, keeping up the flight in a very regular manner for no less than ten complete rounds. M. Delagrange kept the aeroplane at a height of 12 to 22 feet above ground. He landed very easily at the end of the ten rounds. It is of course understood that he did not touch ground during the whole time. This performance was officially controlled by members of the Italian Aeronautic Club, including a number of officers; also by a delegation from the International Aeronautic Federation which included Mr. Cortlandt Field Bishop, president of the Aero Club of America; Prince Doria, Duke Gallese, and others. The committee had erected four poles on the Place, and the distance for one round was measured beforehand by means of a 300-foot cord. After the performance the committee signed a report addressed to the Paris Club. On the following day M. Delagrange made a number of evolutions in the presence of the French Ambassador, M. Barrière, but as there was a high wind blowing, the flights were not very long on this occasion. At 7 P. M. he made another series of three flights in the presence of 10,000 spectators. These lasted 6, 3, and 7 minutes respectively, the longest distance covered being nearly 4 miles. The enthusiasm of the public was great, and the aviator was borne in triumph from the field. On June 1, while flying again before the Queen, Queen Mother, and Crown Prince of Greece and a large number of sportsmen, the aeroplane, after making three-fourths of a circuit, suddenly plunged to the ground from a height of 12 feet and was somewhat damaged, although its daring pilot escaped uninjured. In attempting to avoid striking some piles of wood, M. Delagrange suddenly made a wrong move. After repairs had been made, the aeroplane was shipped to Milan, where, on June 10, M. Delagrange made several short but successful flights above the Place d'Arms in the presence of the Queen. The following day, just after the aeroplane had started and was rolling along on the ground, the crankshaft of the motor is reported to have broken. Further flights cannot be made until a new crankshaft is received from Paris.

In a recent communication to the Royal Society, upon an investigation as to the atomic weight of radium, Prof. Thorpe states that from his experiments on radium chloride obtained from residues of the uranium workings of the mines at Joachimsthal, in Bohemia, he finds that this is 227. This figure is in very close agreement with that determined by Madame Curie, and has a special interest, owing to the fact that it throws light on the place of radium in the system of the elements and on its origin.

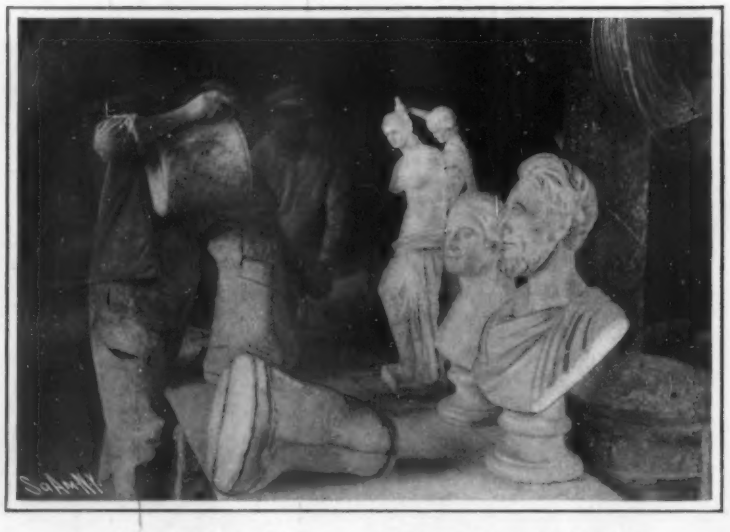
Department in Which the Tints and Colors Are Applied.

Removing a Bust from a Gelatin Mold.

A Greyhound and Its Plaster Shell.

Pouring the Composition Into the Molds.

Another View of the Painting Department.



Another View of the Pouring of the Composition Into the Molds.

The Scraping Department.

Scraping the Inside of a Vase.

MAKING CASTS IN GELATIN MOLDS.

MAKING CASTS IN GELATIN MOLDS.

BY W. FRANK M'CLURE.

The making of composition statuary, statuettes, busts, plaques, and other such articles is an interesting industry which has been growing rapidly in recent years in America. By means of a system of molds the world's masterpieces in art, both ancient and modern, are exactly reproduced. Pieces which in marble would be financially beyond the reach of the majority of people, thus become a part of the average home. The accompanying photographs illustrate the making of these casts in gelatin molds. The composition used is known as "Florentine alabaster," and the workmen are mostly Italians who learned their trade in the motherland.

The original molds for statuary of this kind come chiefly from France, Germany, and Italy. In the olden cities of these countries the greatest numbers of the world's masterpieces are to be found. Most of the church statuary, duplicated in this and other countries, is modeled from the celebrated originals in Rome, Venice, and Milan. It is said that even the village churches of Italy contain some rare treasures of this kind. The museums of London also add to the long list of originals, not to mention notable private collections. From all such, original models must first be cast and then brought to this country.

From the model which comes to the factory a gelatin mold is made in the following manner: A plaster shell is formed in two parts, large enough so that when fitted together they will permit the placing of the model within, and at the same time leave a requisite space between it and the sides of the shell. The parts of the shell after having been placed about the model are tied with ropes. An opening remains at the top.

Through the opening hot gelatin is poured until it fills the entire space between the model and the shell. The gelatin soon begins to solidify, but does not adhere to either the model or the shell. In twelve hours the ropes are untied and the shell taken apart. The solidified gelatin is left still incasing the model. To remove the model within, the gelatin is now cut lengthwise with a sharp knife into halves. The model then comes forth, having faithfully performed its mission, that of leaving its imprint in the gelatin which surrounded it.

After treatment with alum and other chemicals, the gelatin mold is greased and put together and the shell is again tied about it as at first, the only difference being that at the center there now exists a hollow where before stood the original model. It is this hollow space which gives shape to the finished statue. The composition from which the statue is to be made is poured through an opening into the cavity referred to, and the operator, taking shell and all upon his knees, shakes it about with a dexterity that sends the liquid composition into every portion of the design on the gelatin walls. After the first coating has been given to these gelatin walls, the composition which remains is poured out. A little later the operation is repeated, leaving a second coating upon the interior. The number of repetitions depends upon whether the finished product is to be solid or hollow.

In not more than a half hour, the shell is taken apart, and then the halves of the gelatin mold, and there is left standing the new statue in exact duplicate of the original. Large or intricate pieces of statuary are often made in several distinct molds and the parts later joined together. The statues or pieces next go to the hot room for not more than forty-eight hours, and next to the scraping room. As each bust, statuette, or other piece comes from its respective mold, there remains upon it a mold seam—a slightly raised line which is left where the parts of the gelatin mold join. By skillful scraping this line is entirely obliterated.

It is also the work of the force in the scraping department to remedy all defects. Despite the pains taken by the molder in his work, perhaps a little piece may be missing from the cheek or forehead, or a slight tip from the ear of a statuette. With deftness the workman molds a new piece from the wet composition and, after it is put in place, he chisels and scrapes it into shape. When the seam already referred to crosses the ears or a lock of hair, especial delicacy is required in the scraping. Deftness of manipulation in all this process is quite as essential as in the case of the sculptor of marble. The large variety of subjects and designs gives this department much of the interest of an art museum. In the plant where the accompanying photographs were made, there are a thousand distinct patterns and designs. Here is a row of Hiawatha Indians. Above them are numerous busts of Napoleon, Apollo, Diana, Mozart, and Beethoven. Resting on a long table are hundreds of match boxes. In another place are plaques representing "Cupid in Repose," "Love and Plenty," "The Flight of Time," and many other pieces of art.

When otherwise completed, each piece is dipped in a composition of oil and chemicals, and is then ready for the paint room. Whether it is to be in natural colors, tints, antique ivory, or bronze, the greatest care must be taken in the mixing of the colors. There are very many different styles of finish. Bright colors are usually applied to church statuary, the brightness being subdued into a beautiful hue by the soft rays of the wax candles.

A GERMAN COMPASS-TESTING STATION.

BY THE BERLIN CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

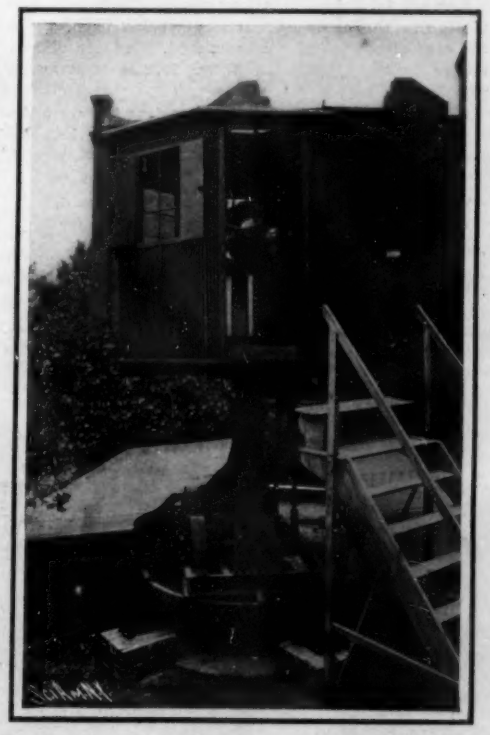
A unique institute, in which the numerous compasses intended for use in the German navy are submitted to careful tests, is situated at Friedenau, near Berlin.

Laymen will hardly realize the exceedingly important part the compass is bound to play on board warships. Three to ten compasses are generally provided, according to the size of the ship, and these are distributed over several decks, so that some of the compasses will always be available, even though the vessel be partly destroyed during a fight.

Reproducing the Conditions of a Storm at Sea.

The testing station above referred to is shown in the accompanying photographs, in one of which the casing of a compass under test may be seen through the open door. The testing tower is subjected to all kinds of motions, rotating, shaking, pitching, and oscillating, all of which can be effected simultaneously, and to any degree desired. In fact, any motions to which warships are liable in rough weather or in maneuvering are generated by the machinery of the testing tower.

The artificial voyage of the tower is started at a signal, when the whole of the construction commences to move, at the speed of a turning torpedo boat, pitching and shaking as though the ship were steaming in a rough sea. The tower is turned round in from 1¾ to 6¾ minutes, in accordance with the time taken by a torpedo boat or liner respectively. The testing station (as illustrated above) can be tilted through an angle of up to 30 degrees, and is made to perform oscillations of 2½ to 8½ seconds duration. This obviously makes the tower a by no means comfortable place to stay in; in fact, many young students of navigation have suffered very severe attacks of sea-sickness during its operations. Magnets allow the directive force of the compass under test to be weakened artificially to 0.02 of its value; but even under such adverse conditions there must be no alteration in the position of the compass rose.



The Testing Tower, Showing a Compass Under Test.

A GERMAN COMPASS TESTING STATION.

The most serious drawback to safe compass readings, as is well known, is due to the enormous rotating gun turrets, the cast-steel gun acting on the sensitive compass like a heavy magnet rod, thus producing errors of up to 45 degrees in the deflection of the compass card or rose, which obviously should be taken into account during observations.

A shot from a heavy gun, e. g., a 10-inch gun, will result in such heavy oscillations as to produce molecular motions in the magnet of the compass, thus altering the magnetic moment of the latter, and requiring a careful correction after each shot.

Method of Making Lantern Slides and Positive Paper Pictures Direct in the Camera Without a Negative.

The following plan of securing a direct positive picture on a plate or paper in the camera from nature, or the reproduction of a transparency on glass or paper on another sensitized plate or sheet of paper without the use of a negative, was recently described at the Thornton Heath Photographic Society in England by Mr. W. Wood, and reported in the Amateur Photographer and Photographic News as follows: An enlargement was made from a negative on thin bromide paper, and developed for three minutes in—

Water	1 ounce
Amidol	5 grains
Sodium sulphite	24 grains
Potassium bromide, 10 p.c. sol.	3 minims

The exposure was obtained by test pieces and judged by transmitted light, the portion selected showing a slight veiling of the high lights.

The prolonged development was to insure the reduction of the whole of the silver bromide affected by the light. After washing, the print was bleached in

Water	10 ounces
Potassium bromide	150 grains
Nitric acid	1 drachm

It was left in this solution until the shadows were only visible as a faint yellow.

Washing out this solution can be done by water alone, but it is a lengthy task. Five minutes' immersion in the following is sufficient:

Water	1 ounce
Sodium sulphite	200 grains
Potassium metabisulphite	10 grains

A thorough wash removes the last of this clearing solution, and the bleached print is exposed to incandescent light for one minute, five or six inches away.

The print is now redeveloped in the first solution, and gives a negative containing all the graduations of the original. Development should be for ten to fifteen minutes to secure sufficient density. Fix in the usual hypo bath, wash and dry. After the bleaching, all operations may be conducted in the light. A good 10 by 12 enlarged negative was made. The lecturer said this method was equally successful with plates.

To reproduce lantern slides direct in the camera, the prepared 3¼ x 4 lantern plate is put in the plate holder with the film side down and the glass side up, so the latter will face the rear of the lens. Some black paper or soft material should be put under the plate to prevent the delicate film from being scratched. The focusing glass of the camera should be reversed, with the ground-glass side out, to bring it in the same plane with the sensitized film on the plate. Then after the picture is arranged on the ground glass of the camera, the plate holder is inserted and exposure is made in the usual way. The image is then developed and reversed as above described, and a positive lantern slide is obtained. After washing and drying, it may be mounted and used directly in the lantern.

If a sheet of bromide paper is substituted for the glass plate a positive paper print is obtained but the position of the objects will be reversed unless a prism is used in front of the lens or the exposure is made through the back of the paper.

An International Exhibition of Kinematograph Apparatus.

An international exhibition of apparatus and materials employed in the production of moving pictures will be held in Hamburg from June 13 to June 28. It will include sections devoted to photographs and films, photographic processes, optics and projection, electric motors, illumination, musical accessories (pianos, orchestrions, phonographs, etc.) heating appliances, arrangement of theaters, technical literature, and advertising.

Practical Experiences in Varnishing.—Varnish on size paint. To varnish over size colors, coat them with a solution of dextrine or thin starch till a light polish is obtained. With fine work, where it is important that the subsequent coat of varnish should not be absorbed by the size color, thus darkening the latter, soak the coat of size paint, after the above treatment, once more with gelatine. Dammara varnish with a little linseed oil (thickened by standing) should be used for varnishing.

A REMARKABLE MOUNTAIN RAILWAY.

BY DR. ALFRED GRADENWITZ.

While the Mendel railway with a gradient of 64 per cent and the Vesuvius railway with a gradient of 63 per cent have heretofore held the record as the steepest passenger cable railways of Europe, they are far surpassed by the Virgl railway, recently constructed in the proximity of Bozen, Tyrol, which in its upper section reaches a gradient of 70 per cent, while the remainder has a gradient of 66 per cent. In spite of these remarkable figures, it is claimed that the superstructure and brakes are subjected to far less wear than those of the Mendel railway, because the cars of the former are smaller, while the compensating rope, which gives so much on the Vesuvius railway, is dispensed with.

The railway leads up to the Virgl terrace, situated on the River Eisach, in the neighborhood of the town of Bozen. Owing to the exceptional steepness of the mountain slopes and the crowded houses, roads, rivers, and railway tracks, which render the blasting work dangerous, special difficulties had to be overcome in laying out this railway. After examining various schemes, an electrical wire-rope system was adopted, which, in spite of a slight surplus in the first cost, allowed the lower and upper stations to be located in the most advantageous positions, and the railway to be laid in solid ground.

Braking tests with fully-loaded cars, made on the gradient of 70 per cent with a self-acting brake, gave very favorable results. On setting the brake the car would come to a stop within a distance of about four feet, half of which distance was traversed while the brake-shoe was moving into frictional engagement with the wheel.

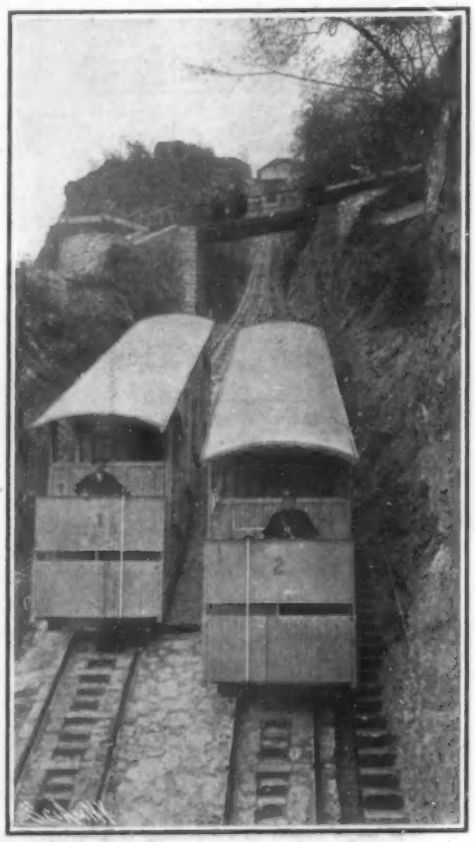
The railway starts from the southern end of Bozen, the station partly penetrating into the embankment of the Southern Railway, across which a viaduct had to be constructed. The latter is a sheet-metal structure, with lowered runway and concrete central pillar. The iron-frame station building is connected to this viaduct.

The railway, starting from the lower station, runs in a westerly direction over a curve of 275 yards radius, and then straight up to the Virgl lookout. Here, in connection with the station building, an extensive restaurant and large terraces have been installed. Owing to its exceptionally favorable situation, the lookout has proved a great attraction, both to the local public and to tourists, as shown by the fact that despite the unfavorable season, an average of 500 to 1,000 persons were conveyed each Sunday from the day of opening (November 20, 1907) until the end of the year.

About three-quarters of the track is situated in mountain cuts, the only considerable elevation being a concrete vault viaduct, 79 feet long, the abutments of which have a difference of level of 82 feet. While an iron viaduct, with two spans of 72 feet each, had been at first provided for, the present design of the viaduct was eventually given the preference, though the cost of its construction amounted to upward of twice the original estimate. In connection with this imposing structure should be mentioned a road viaduct, close to the lower station, and a viaduct following close upon the large concrete arch, and which also is formed with concrete arches. The gage of the railway is one meter (3.28 feet). Beside the stairway the track in cuts on the mountain side is provided with three steps between each two sleepers. The superstructure is designed in accordance with that of most high-gradient motor-driven, wire-rope railways, and comprises grooved rails 33 feet long and weighing 54 pounds per yard. In addition to the terminal fishplates, each rail is provided with a pair of intermediate fishplates to take the severe braking strains.

The drive gear is located in the upper station, and operates the cars at a speed of five feet per second, the whole distance thus being covered in five minutes. An alternating-current motor generating 55 horse-power is used. The current is supplied at 3,450 volts from a neighboring power plant, and is stepped down to about 550 volts.

A hand brake and an automatic brake are placed on each car. The automatic brake acts whenever the speed of the drive gear exceeds the normal speed of travel by 15 to 20 per cent; whenever the car runs too far into the upper station; whenever the driver thinks fit to set it by hand; and finally, when the current leading to the upper station is interrupted in the transmission line or in the power station. In all these cases the current supplied to the motor is also automatically interrupted. The wire cable is 3 centimeters



Cars Passing Each Other at the Switch.

(1.2 inches) in diameter and has a breaking strength of 110,000 pounds, the maximum traction being 11,000 pounds.

The car is divided into four compartments and two platforms, the outer compartments being open, while the central compartments are closed. The car affords sitting accommodation in these four compartments for 32 passengers.

The plans of this interesting construction were designed by Engineer E. Strub, of Zürich, to whom we are indebted for the photographs herewith reproduced.

A Unique Concrete Arch Viaduct 79 Feet Long.

A REMARKABLE MOUNTAIN RAILWAY.

Electro-Galvanizing Patent Suit Dismissed.

The rapid substitution of the electro-deposition of zinc for the old-time hot process had, as one incident, the bringing of a patent infringement suit which has now reached the final stage in the court of first instance. The U. S. Electro-Galvanizing Company and Louis Potthoff, the president of that company, claiming ownership of a patent, reissue No. 11,624, granted August 3, 1897, on the application of Dr. Alexander, a German inventor, brought suit against the Hanson & Van Winkle Company, of Newark, in the United States Circuit Court for the District of New Jersey. It was claimed by complainants that the patent was the foundation of the business of electro-galvanizing in this country and entitled to a liberal interpretation. But the court makes short work of this, saying:

"The patent is in no sense basic. . . . The patent is claimed to be generic, or at least the first in the art which has proved successful. It should be said in this connection, however, that while it appears that the complainant corporation has indeed built up a considerable business of the character indicated by the patent, it does not appear, certainly not conclusively, that the patented process and bath are practicable. . . . No present licensee of the complainants is produced to show that the process as practised by him is the same or substantially the same as that described in the patent, hence it is at least doubtful under the evidence, whether the patented bath and process are really valuable, notwithstanding the testimony of the president of the complainant corporation that he has always followed them."

Without going extensively into the details of the suit, it may be said that the patentee had in view the depositing of some aluminium with the coating and devised and claimed means for producing a strongly basic solution, using commercial chloride of aluminium and dissolving, under conditions to produce saturation, the reguline coating metal therein, then adding a chloride of the coating metal and maintaining the salts in solution by employing an organic acid or sugar. He employed also an anode of the coating metal.

The defendants contended, among other things, that their process involved an acid instead of a basic bath; that their process was highly useful, while complainants' had been unsuccessful and was not adapted to produce the aluminium alloy specified; that the patent was invalid for anticipation; and that they did not infringe.

In the decision just handed down by Judge Cross dismissing complainants' bill, the defense of non-infringement is found sufficient. The court's opinion on this point is rendered at considerable length. Prof. Chandler (who is referred to in the opinion as "the eminent chemist and scientific expert") is quoted extensively in the portions of his deposition pointing out the difference between the two processes. His testimony to the effect that aluminium is not deposited in the coating is particularly noted. The court concludes:

"For the following among other reasons then, the defendant does not infringe: It does not make the alloyed coating of the patent, employs no basic salts, but rather makes and maintains throughout an acid bath; does not use chloride of aluminium in its salts, does not use any organic substance with its salts or bath, or any equivalent thereof, and its bath is composed in part of different ingredients from the complainants', is prepared differently and under different conditions, and its ingredients, insofar as they are the same, appear in different proportions.

"The bill of complaint will accordingly be dismissed with costs."

The theory of the radiation of the Auer incandescent gas mantle is discussed by M. M. Foix in the Journal de Physique. It is generally admitted that the mantle owes its brilliance to its selective radiation, which appears, according to the researches of Prof. Rubens, to be brought about by the addition of a little oxide of cerium to oxide of thorium. M. Foix now comes to the conclusion that the luminous efficiency of the mantle can be increased by carrying the dilution of the oxide of cerium in the oxide of thorium a further stage, the result being brought about by the diminution of the infra-red radiation of the mantle and a consequent increase of its temperature. The best proportion is 1 of cerium to 100 of thorium.

Patent Department

AN AEROTUBE FLYING MACHINE.

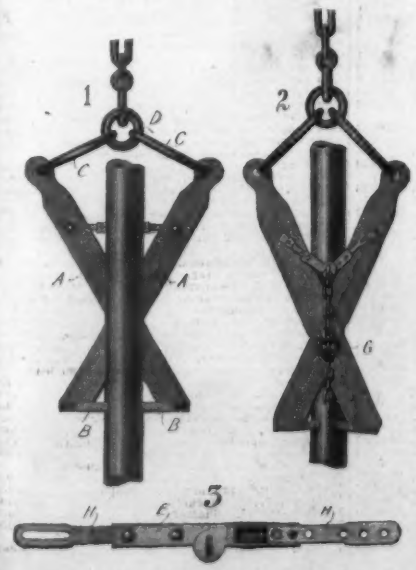
The accompanying illustration shows a new form of aeroplane, upon which a patent has recently been granted to Mr. W. Pars, of Seattle, Wash. The inventor's main idea is to utilize the air rarefaction in front of a revolving propeller, to obtain an upward

AN AEROTUBE FLYING MACHINE.

suction or lift. He believes that he accomplishes this by placing in front of the lower half of the propeller a semi-tube or cylinder. In order to also utilize the air which is driven back at high velocity from behind the propeller, he provides another semi-cylinder placed above the latter, and extending back about the same distance that the lower half-tube extends forward. These two half-cylinders overlap slightly, and the propeller is located at this point, its axis being the same as the axes of the cylinders. A gasoline motor is mounted below and connected to the propeller by a chain for the purpose of driving it. Rectangular curved aeroplanes are placed on each side of the semi-tubes, and horizontal and vertical rudders are located at the rear of the upper tube, and operated by steering wheels placed in front of the aviator, who sits on a saddle back of the engine. According to the inventor, the position of the planes and semi-tubes is such that the air of positive pressure back of the propeller is kept perfectly separated from the air of negative pressure in front of it, the result being that these pressures, and consequently the lifting effect of the curved tubes and planes, are said to be increased, as well as the horizontal thrust of the propeller.

PIPE AND ROD LIFTING TONGS.

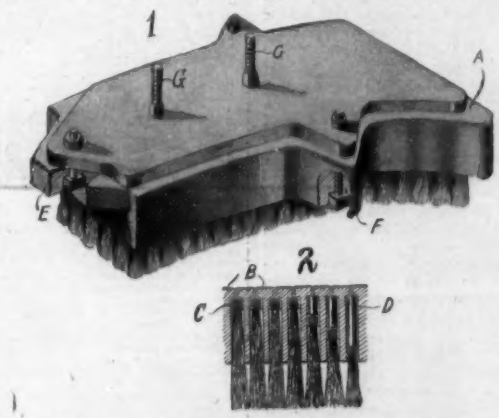
The device illustrated in the accompanying engraving is particularly adapted for use in extracting or inserting lining tubes in the bores of oil wells or deep water wells. It is arranged to firmly grip the body of a pipe or tube, and may be connected with the usual tackle for raising or lowering the tube in a well bore. Aside from its value in this connection, the device may be used for gripping heavy shafts or rods which are to be raised or lowered. As indicated in the engraving, the tongs comprise a pair of lever bars *A*, which are pivoted together by a bolt near their lower ends. Each bar at its lower end is provided with a jaw *B*, projecting at right angles thereto. The jaws are formed with concave recesses at their inner edges, so that they will fit around the tube or rod that is to be lifted or lowered into the well. The upper ends of the bars *A* are connected by links *C* to a ring *D*, which may be engaged by the hoisting mechanism. To control the lever bars *A*, a tripping link *E* is provided, which is shown in detail in Fig. 3. It comprises a pair of toggle members connected by a rule joint, and having an eyebolt for a pivot. A chain *F* attached to this eyebolt passes through a ring *G*, and serves as a means for tripping the tongs. The two members of the tripping link are recessed to receive a pair of extension arms *H*, which are respectively connected at their outer ends to the bars *A*. One of the extension arms is formed with a slot, which engages a pin on the arm and thus provides for a certain amount of play. The other extension arm is formed with a series of boltholes at each end, so that it may be secured to the bar *A*, as well as in the recessed member, at different adjustments. In operation, the pipe that is to be lifted is gripped by the tongs, and the tripping link is set in the position shown in Fig. 1. In this manner the pipe may be raised or lowered at will, and when the proper position has been reached, a pull on the chain *E* will trip the toggle *C* and release the pipe. A patent on this pipe and rod lifting tongs has recently been secured by Mr. Oliver Wilson, of St. Edward, Neb.



PIPE AND ROD TONGS.

AN IMPROVED DABBING BRUSH.

The accompanying engraving illustrates an improved brush of the type used in wool-combing machines, and technically known as a dabbing brush. The brush is provided with means for adjusting the bristles as they wear down. It is also fitted with a metallic back plate and means for rigidly and securely fastening it to the actuating mechanism. As shown in the illustration, a wooden stock *A* is provided, in which are a series of bores communicating with openings formed in the top of the stock. Through these openings drawing wires are run, with which the bristles are secured in the bores. The sectional view, Fig. 2, clearly illustrates this feature of the invention. The wires *B* pass under the heads *C* of the bristles, and are secured on the upper face of the wooden stock. As the bristles

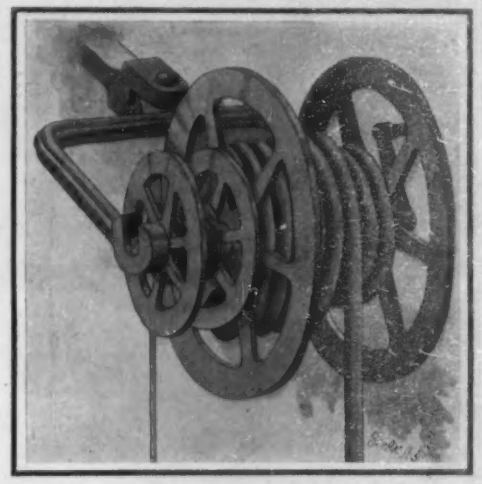


DABBING BRUSH FOR WOOL-COMBING MACHINES.

wear down plugs *D* are inserted in the bores above them. The drawing wires are passed through central bores in the plugs, and may be tightened in the usual way. The plugs fit the bores snugly, and it will be evident that when the wires are tightened, the bristles will be as firmly secured as those with which no plugs are used. The upper face of the stock is covered by a metallic plate, preferably of aluminium, which approximately conforms to the shape of the stock. This plate is secured to the stock by means of bolts, which pass through a projecting tongue *E*, and a pair of lateral projections *F* of the stock and plate. The brush is secured to the actuating mechanism by means of a pair of bolts *G*. The heads of these bolts are square and fit snugly into square recesses in the plate, so that they are unable to turn therein and work loose. Heretofore the brushes have been fastened in place by means of screws threaded into the wooden stock, but brushes so fastened are liable to be thrown off when in use in the machine. The inventor of this dabbing brush is Mr. P. Henry, of 1847 Callowhill Street, Philadelphia, Pa.

BRACKET HOSE REEL.

The bracket hose reel illustrated in the accompanying engraving is of the type adapted to be pivotally mounted upon a wall or other supporting surface. The particular advantage of this reel is that it may be supported out of reach of the user, but in such a way that the hose may be wound without difficulty. As the hose is being wound up, the unwound portion will hang downward, permitting the water to run out of same, and obviating the necessity of handling the hose, which may become muddy or dirty during its use. The bracket is of U-shape, with recesses formed in the outer ends of the arm to receive the shaft of the reel. These recesses are inclined toward the back of the supporting bracket, to prevent the reel from being easily displaced from its bearings. The bracket itself is formed with a rearwardly-extending ear, which is pivotally attached to a supporting member by means of a pin. The reel shaft is divided into two separate drums by means of two pairs of disk collars. The larger pair of collars partitions off a section of the drum on which the hose is adapted to be wound up, while the other section is adapted to receive a cable. It will be observed that the hose and cable are wound

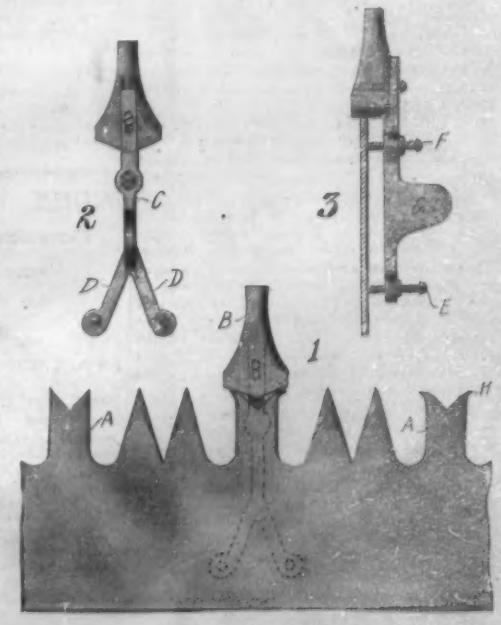


BRACKET HOSE REEL.

in opposite directions respectively, so that when the hose is unreeled the cable will be wound up. Consequently, when it is desired to reel the hose, it is merely necessary to unreel the cable. The reel is also provided with a crank handle, which may be used whenever desired. The inventor of this reel is Mr. Lewis W. Parker, of Mobile, Ala. (Care of B. Rhett & Co.)

SAW SWAGE.

Pictured in the accompanying engraving is a device for setting racker teeth on hand or power-driven wood saws. It has been found that the cutting action of racker teeth is greatly increased, and the resistance to the reciprocation of the saw blade is correspondingly diminished, if the racker teeth are bent outward. The racker teeth are indicated at *A* in the engraving. The saw swage with which the racker teeth are bent outward comprises two members, one a block *B*, and the other a metal bar *C*. The metal bar is formed at its lower end with two divergent limbs *D*. Threaded through the extremities of these limbs are a pair of set screws *E*, provided with jam nuts whereby they may be secured at any desired adjustment. A third set screw *F*, also provided with a jam nut, is threaded through the bar near its upper end. A grip flange *G* serves as a handle for the bar. The swage block *A* is slotted at the rear to receive the upper end of the bar *B*. A screw, threaded into the block and passing through a slot in the bar, serves to hold the two members together, and at the same time to permit a certain amount of vertical play. The swage block is made of hardened steel, and its lower surface consists of a pair of walls that incline or diverge at an obtuse angle. The upper end of the block terminates in a poll of cylindrical shape. The method of using this saw swage is clearly shown in Fig. 1. The swage block is rested in the top of one of the racker teeth, and is properly set by adjusting the set screws. The teeth may then be bent outward, as shown at *H*, by a blow on the poll of the swage block. The inventor of this saw swage is Mr. August Draws, 332 Edward Street, Houghton, Mich.



IMPROVED SAW SWAGE.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

TROUSERS-STRETCHER.—M. B. JACKSON, Hamiota, Manitoba, Canada. This invention has reference to apparel apparatus, and the object is to provide a stretcher which is simple and durable in construction, very effective in operation, easily applied, and readily removed, and arranged to remove bagginess and wrinkles in a comparatively short time.

DRESS-FORM.—L. T. FURNAS, Lima, Ohio. One purpose here is to provide an article of female apparel adapted to be worn beneath the skirts and to extend partially around the figure, being supported from the waist, and the object of the article is to provide means for rectifying deficiencies in the figure, particularly at the hips and back, and also to provide an article adaptable to all conditions and to all persons.

Electrical Devices.

TROLLEY.—A. S. JANIN, New York, N. Y. A purpose in this case is to mount the contact roller upon ball bearings and to provide a convenient means for locking the balls in their races, and likewise to provide a scraper capable of being carried inactive beneath the contact roller and of being quickly and conveniently placed in the upper position to perform its function as a scraper at the same time also serving as a contact, the roller being then removed.

Of Interest to Farmers.

PLANTER ATTACHMENT.—G. WEIDINGER, Circleville, Ohio. This attachment is particularly useful in connection with planters for the sowing of corn, grain, and the like in which a runner is provided with lateral blades to run in the furrow. One object is to provide a device in which the blades are attached to the runner or furrow opener and to the seed depositing tube, in such a manner that all external projections in the runner and blades are avoided, whereby these parts can scour clean by contact when the planter is in operation.

PROCESS FOR EXTRACTING BUTTER FAT FROM FRESH MILK OR CREAM.—MARY E. STRO, Grangeville, Idaho. A process for the extracting of butter fat from fresh milk or cream is involved in this invention, and the object is to rapidly sour fresh milk or cream to facilitate the separation of the butter fat, and, at the same time, without injuring in any way the butter resulting from the churning.

CUTTER FOR SHEEP-SHEARING.—S. L. JOHNSON, Holmbank Lodge, Tyersal, Bradford, England. A rotary cutting disk is employed the periphery of which is tapered to a sharp edge slightly roughened by forming thereon very finely divided serrations or minute teeth. In conjunction with said disk a shield is arranged adapted to collect and comb up the wool so that it may be directed against the edge of the disk and also to prevent the disk from getting into direct contact with the skin of the sheep.

STRAW-CHUTE AND DRAFT APPLIANCE.—F. A. MAGWIRE, Havre, Mont. The design of this invention is to provide means simple in construction, effective in operation, and durable in use, adapted to be detachably secured to the furnace of a traction boiler and enable straw and material of a light character to be used for fuel in the furnace when desired.

Of General Interest.

YEAST COMPOUND.—J. E. YOST, Arkansas City, Kan. This is a dry yeast compound embodying in its composition a body on which the yeast is dried having a large capacity for the ferment used. The body consists of bread, preferably in the form of crumbs, which are dipped into a ferment as that taken from beer or ale tanks or fermented in the common way in mixtures of water, malt, potatoes, sugar, hops, etc.

FINGER-SHIELD.—H. H. FULTON, Chico, Cal. This shield is for use of persons who by force of circumstances are compelled to eat with hands unwashed. It is of such material as paper, which will expand to fit fingers of various sizes and frictionally embrace the same to such an extent as not to drop off, and also in which the finger opening presents a construction to facilitate the insertion of the finger.

MARINE VESSEL.—G. F. TRIBHMAN, Oakland, Cal. The intention in this case is to enable a vessel freely to clear itself when moving through the water. Retardation is overcome by providing walls establishing passages in the after body of the hull, these opening at the sternward facing portions of the hull surface, so that as the vessel moves, air is drawn through the passages and passes out at the after portion of the vessel, thus overcoming the drag or suction at the stern which causes resistance to the forward movement.

TRUNK-HARNESS TIGHTENER.—G. M. POWERS, Portland, Ore. The tightener will prevent trunks being broken open when thrown about by baggage men. The inventor's object is to produce an apparatus whereby a small force may be exerted so advantageously that a person of little strength can readily apply the harness and tighten the same in position.

BUSHING.—G. W. SPENCER, Atlantic City, N. J. The bushing is used in connection with devices for tapping kegs, barrels, and other receptacles containing sparkling liquids, and the object of the improvement is to provide a bushing arranged to form a very tight joint between the tapping device and the wall of the bung hole to prevent leakage.

Musical Devices.

BALANCED SWELL FOR MUSICAL INSTRUMENTS.—SARAH W. CLARK, New York, N. Y. One object in this invention is to provide means whereby a performer on the instrument may by foot pressure vary the position of a moving part of the casing, as, for instance, a piano lid, to open or close the same, or vary the position of a sound deflecting board whereby the sound may be muffled or permitted to freely escape toward or away from the audience.

STRINGED MUSICAL INSTRUMENT.—C. S. WEBER, New York, N. Y. The principal object in this case is to provide means for increasing the tone of stringed musical instruments by means of a second set of strings which are placed on the supporting frame on the opposite side to that occupied by the usual set. This second set furnishes two series of sympathetic strings, one of them being of the same length as the corresponding strings of the main set.

Prime Movers and Their Accessories.

PISTON.—J. E. THOMPSON, Chattanooga, Tenn. The invention is particularly useful in connection with reciprocating engines having piston-actuated valve or reversing rods. An object is to provide a simple and durable piston-head which can be firmly secured to a piston-rod, and which is formed to actuate a valve-rod.

CARBURETER.—C. A. RADER, El Paso, Tex. The object of the inventor is to provide a carbureter arranged to insure a uniform feed of gasoline or the like and without the use of a float, and to control the charge by regulating the admission of air to the charge according to the speed of the engine.

PNEUMATIC FLUE-EXPANDER.—H. KELLY, Houston, Tex. The purpose in this patent is to provide novel details of construction for a flue expander, which will be actuated by air pressure, will effectually affix a flue end in the sheet, will avoid all jar and percussion thereupon and obviate the contingency of a flue creeping endwise while the operation of expanding the ends thereof is being conducted.

GOVERNOR.—A. DICKERSON, American Fork, Utah. The object of the invention is to provide means for governing and equalizing the admission of steam or other motive fluid to the chest and cylinder of an engine, so as to render the action of the engine practically equal or isochronous under variations in the loads imposed on the engine or the variations in the pressure in the motive fluid.

HAND-HOLE CLOSURE.—H. G. OSBORNE, Pittsburg, Pa. The aim of the invention is the provision of a closure, arranged to form an exceedingly tight joint to prevent leakage of water or steam, to allow convenient removal whenever desired for gaining access to the tube to be cleaned, and to prevent displacement of the closure by the pressure of steam.

Railways and Their Accessories.

TRAIN-PIPE COUPLING.—E. B. WITTE, Trenton, N. J. The invention relates to improvements in couplers employed for securing together the ends of pipes carried on railroad trains for use in an air brake system, a train signal, or a steam heating system, and more particularly to certain improvements over the construction disclosed and claimed in a prior application filed by Mr. Witte.

RAILWAY-RAIL JOINT.—W. E. JOHNSON, Porter Township, Mich. One purpose of the invention is to provide a construction for the meeting of ends of railway rails, of a simple and inexpensive character, and whereby, when joints are made thereby, the rails will be practically continuous, and whereby also the joint will be smooth and scarcely discernible.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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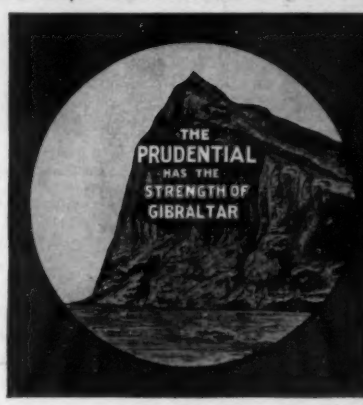

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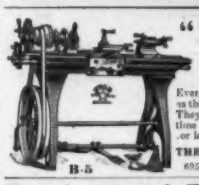

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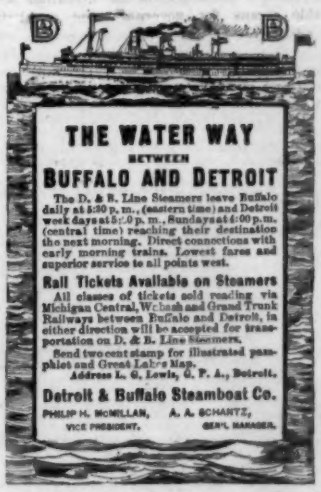
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Inquiry No. 8639.—Wants stencils for decorative borders such as are used around half tones.

Inquiry No. 8641.—Wanted to buy a self lighting gas burner.

Inquiry No. 8642.—Wanted to buy a gasoline motor inspection car standard gage.

Inquiry No. 8643.—Wanted to buy concrete post machines.

Inquiry No. 8644. Wanted address of glass tube manufacturer who does bending.

Inquiry No. 8645.—Wanted to buy parts for curling irons.

Inquiry No. 8646.—Wanted to buy cheap small motor from ¾ to 1 horse power, single phase 60 cycle, 110 volts.

Inquiry No. 8649.—Wanted to buy non-inflammable celluloid.

Inquiry No. 8650.—Wanted to buy file cutting machinery.

Inquiry No. 8652. Wanted address of manufacturers of drop forged wrenches.

Inquiry No. 8653.—Wanted addresses of dealers in sheet steel, New York city preferred.

Inquiry No. 8654.—Wanted addresses of case-hardeners in New York.

Inquiry No. 8656.—Wanted to buy parts of models and gear wheels.

Inquiry No. 8660.—Wanted to buy creosote making machinery.

Inquiry No. 8661.—Wanted to buy machinery for making cutlery.

Inquiry No. 8662.—Wanted to buy small machine for drawing thread from cotton and machine for making lozenges.

Inquiry No. 8663.—Wanted to buy file cutting machines.

Inquiry No. 8666.—Wanted to buy screw making machinery.

Inquiry No. 8667.—Wanted to buy needle, pin and pen machinery.

Inquiry No. 8669.—Wanted to buy machinery for making rifle barrels.

Inquiry No. 8671.—Wanted to buy welting and machinery for making same.

Inquiry No. 8672.—Wanted to buy 2,500-pound gasoline traveling crane.

Inquiry No. 8673.—Wanted to buy folding umbrellas.

Inquiry No. 8674.—Wanted to buy machinery for cultivating rice and making Yuca starch.

Inquiry No. 8675.—Wanted to buy machinery for making sawdust into bricks for fuel.

Inquiry No. 8676.—Wanted to buy flat irons heated by denatured alcohol.

Inquiry No. 8677.—Wanted to buy model safety razors.

Inquiry No. 8678.—Wanted to buy cheap sewing machines.

Inquiry No. 8679.—Wanted to buy cheap guns.

Inquiry No. 8680.—Wanted to buy cheap watches.

Inquiry No. 8681.—Wanted to buy envelope making machines.

Inquiry No. 8682.—Wanted to buy model of old battleship "Maine."

Inquiry No. 8683.—Wanted to buy plant for making cassava starch.

Inquiry No. 8684.—Wanted to buy fountain pens in quantities.

Inquiry No. 8685.—Wanted to buy 1½ to 2 inch No. 13 to 18 tempered spring steel.

Inquiry No. 8686.—Wanted to buy machine for dusting talcum on sheets.

Inquiry No. 8687.—Wanted to buy motor plows.

Inquiry No. 8689.—Wanted to buy alcohol engines for same amount of power as 8C8.

Inquiry No. 8691.—Wanted to buy for export to British Guiana alcohol motors.

Inquiry No. 8692.—Wanted to buy kerosene oil motors for export.

Inquiry No. 8693.—Wanted to buy meteorological instruments.

Inquiry No. 8694.—Wanted to buy fly wheels and ball bearings.

Inquiry No. 8695.—Wanted to buy bathing suits.

Inquiry No. 8696.—Wanted to buy toy balloons.

Inquiry No. 8697.—Wanted to buy zinc can screw tops.

Inquiry No. 8698.—Wanted to buy a hydrochloric acid plant.

Inquiry No. 8699.—Wanted to buy two-stranded soldered wire for heddles.

Inquiry No. 8700.—Wanted to buy burglar proof door fasteners.

Inquiry No. 8701.—Wanted to buy solar engines.

Inquiry No. 8702.—Wanted to buy machinery for filling and sealing paper boxes.

Inquiry No. 8703.—Wanted to learn address of music printers.

Inquiry No. 8704.—Wanted address of Raolin expert.

Inquiry No. 8705.—Wanted to buy double shaft engines for automobiles.

Inquiry No. 8706.—Wanted to buy ink and mucilage bottles and labels.

Inquiry No. 8707.—Wanted to buy hand power vacuum cleaner.

Inquiry No. 8708.—Wanted samples and prices on boxes, bottles, jars, cartons, etc., to put up proprietary articles.

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Inquiry No. 8710.—For machinery for carding, spinning and weaving jute.

Inquiry No. 8711.—Machinery for making hooks and eyes.

Inquiry No. 8712.—Machinery to cut ditch 18 inches to 2½ feet wide and from 3½ to 10 feet deep for laying tiles.

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Inquiry No. 8725.—For manufacturers of a needle-threader, not the thimble and needle combination.

Inquiry No. 8726.—For parties who make "Yankee Metal Polish."

Inquiry No. 8727.—For manufacturers of small stills for distilling alcohol.

Inquiry No. 8728.—Wanted the address of The Frear Novelty Co.

Inquiry No. 8729.—Wanted a machine for manufacturing berry-crates complete.

Inquiry No. 8730.—Wanted a 10 to 30 horse-power gasoline, kerosene engine, mounted on a 3½ to 4 ton cast-iron truck with dirt road wheels.

Inquiry No. 8731.—Wanted a rice mill or huller that delivers the rice entire and separate from the hull.

Inquiry No. 8732.—For manufacturers of industrial alcohol machinery.

Inquiry No. 8733.—For manufacturers of gates to be opened from a buggy.

Inquiry No. 8734.—Wanted to buy fusible metal which melts at 160 degrees, similar to that used by manufacturers of automatic sprinkler heads, also who makes the disks used to keep the head normally closed.

Inquiry No. 8735.—For parties making a still for the purpose of extracting alcohol from saw-dust.

Inquiry No. 8736.—For manufacturers of machinery for making matches, also machinery for making purses and hand bags.

Inquiry No. 8737.—For manufacturers of machinery for making tooth-brushes, shaving brushes, galvanized water buckets, hooks, nibs and holders.

Inquiry No. 8738.—For parties manufacturing casein cement.

Inquiry No. 8739.—Wanted machinery to make pencil and pen retainer made of spring wire.

Inquiry No. 8740.—For manufacturers of Chicago typewriter.

Inquiry No. 8741.—For manufacturers of fireless cookers.

Inquiry No. 8742.—For manufacturers of water still, also of thermometer tubing.

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Speed regulating device, A. P. Schmucker 890,323
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Spring wheel, B. F. Diffenbaugh 890,223
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Target trap, J. W. Haughawout 889,926
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Telegraphone, H. R. Stuart 890,195
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Therapeutic apparatus, T. Powell 889,984
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Ticket issuing and recording machine, J. F. Ohmer 890,170
Time alarm, G. Hogan 889,929
Tin from crude tin or tin alloys electrolytically, obtaining pure, O. Stelner 890,249
Tipple, steam, F. R. Willson, Jr 890,321
Tire casing, automobile, C. L. Higgins 889,927
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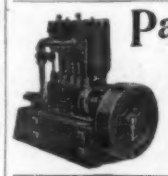

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Petroleum, refined, J. W. Hunnewell & Co.	69,333
Pills, D. Mortimer	69,385
Pipe cleaning preparation, chemical, Maxim Chemical Co.	69,384
Pomade, R. A. Oleshak	69,396
Powder for the nails, toilet, L. Spiro	69,386
Powder, gun, Laflin & Rand Powder Co.	69,372
Purses, pocketbooks, and hand bags, G. Bradt	69,400
Remedy for diseases in turkeys, C. M. Evans	69,381
Remedy for tired feet, corns, and bunions, E. Churchward	69,379
Ribbons, Carson Pirie Scott & Co.	69,402
Ribbons, velvet, W. Openhym & Sons	69,411
Rubber roofing, J. L. Lindsay	69,393
Salt, table, Dento Chemical Co.	69,332
Sardines and canned fish, Strohmeyer & Arpe Co.	69,365
Seeds, bulbs, and plants, W. J. Smith	69,335
Stain and paint, Hockaday Paint Co.	69,343
Stoves and parts thereof, Buckwalter Stove Co.	69,401
Tires, rubber, Manufacturers' Supplies Co.	69,407, 69,408
Tonics, Barnes & Hille	69,377
Tools and tool parts, certain, George Nash Co.	69,341
Tooth filling composition, J. A. Sprague & Co.	69,413
Underwear, merino, Medlicott Co.	69,373
Varnishes, Twin City Varnish Co.	69,350
Waists and shirt waists, ladies' dress, S. Schlein	69,374
Watch movements, Elgin National Watch Co.	69,391
Wood strengthener and preservative, chemical, P. C. Reilly	69,334

LABELS.

"Complexion Cream Purity Brand," for a complexion cream, Carleton & Hovey Co.	14,235
"Gordon's Bitters," for bitters, Gordon Bitters Co.	14,237
"J. B. Actress's Health and Beauty Bath Powder," for a bath powder, J. L. De Zeabuilt	14,236
"Narragansett," for ribbed shirts, E. D. St. George Co.	14,239
"Noble Roman," for cigars, Schmidt & Co.	14,232
"Old Q," for cigars, Schmidt & Co.	14,234
"San-Vita Indian Remedy," for a medicinal compound or proprietary medicine which is a remedy for nervous affections, nervous diseases, and nervous prostration and for St. Vitus's dance, E. Stryker	14,238
"Sir Philip," for cigars, Schmidt & Co.	14,233
"Torpedo Cigar," for cigars, J. W. Michel	14,231

PRINTS.

"Say Boys! Wear Scott's Joplin Special," for overalls, Joplin Overall Co.	2,295

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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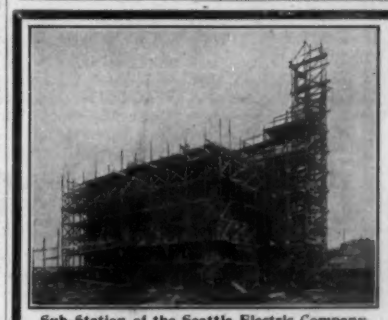

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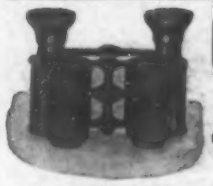

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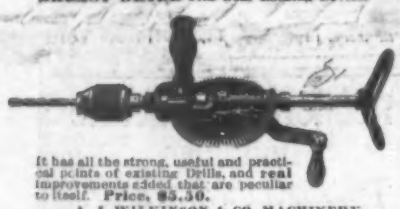

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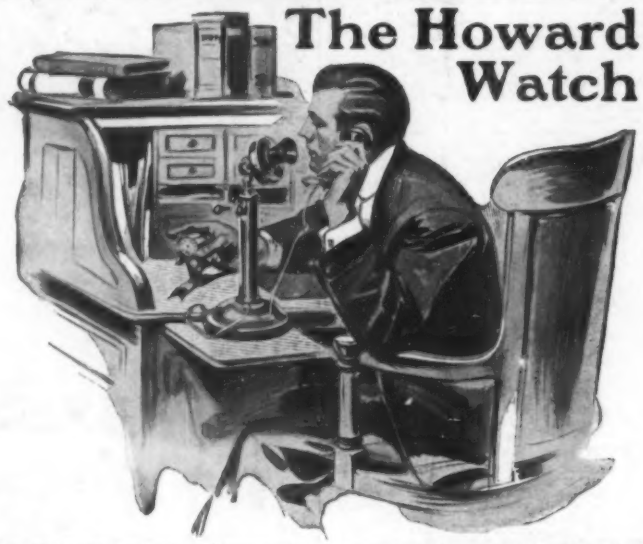

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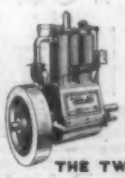

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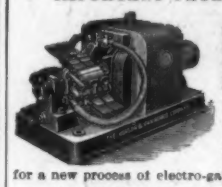

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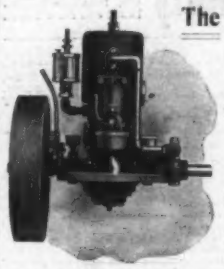

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